

April 15, 1952

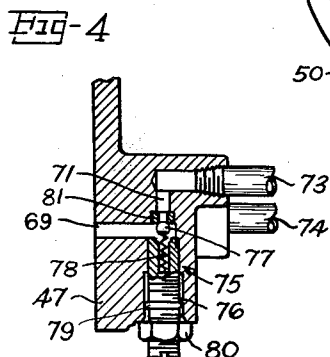
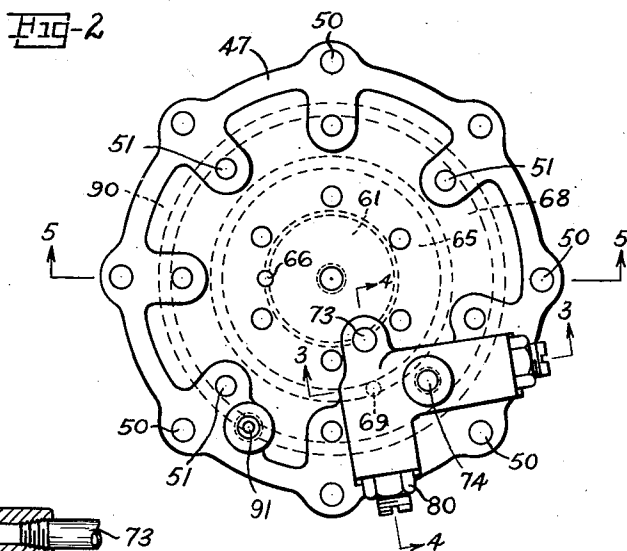
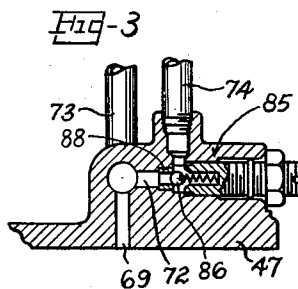
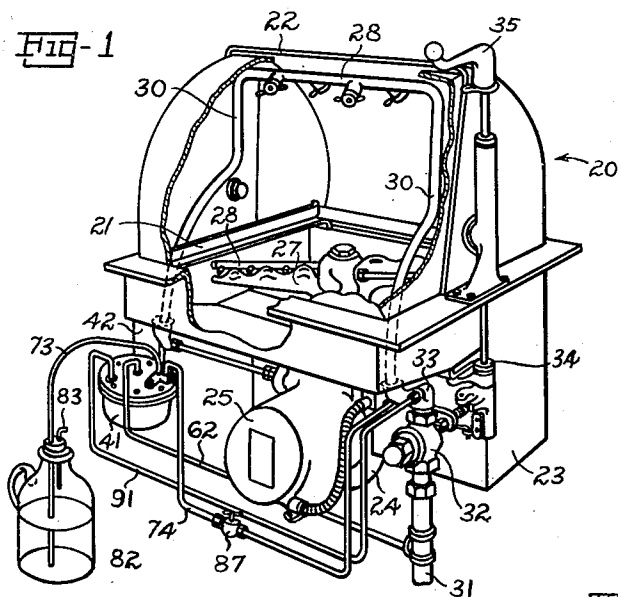
G. B. FOX ET AL

2,592,886

DISINFECTANT INJECTOR FOR DISHWASHERS

Filed Aug. 22, 1946

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

Fig-5

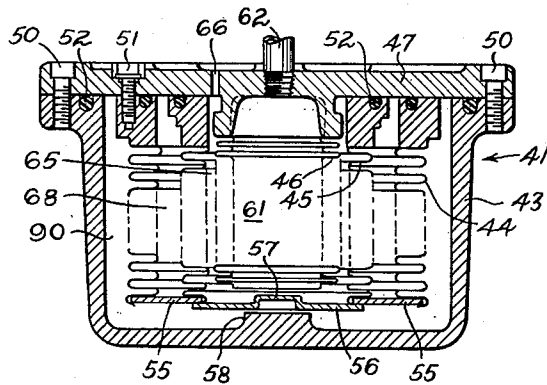
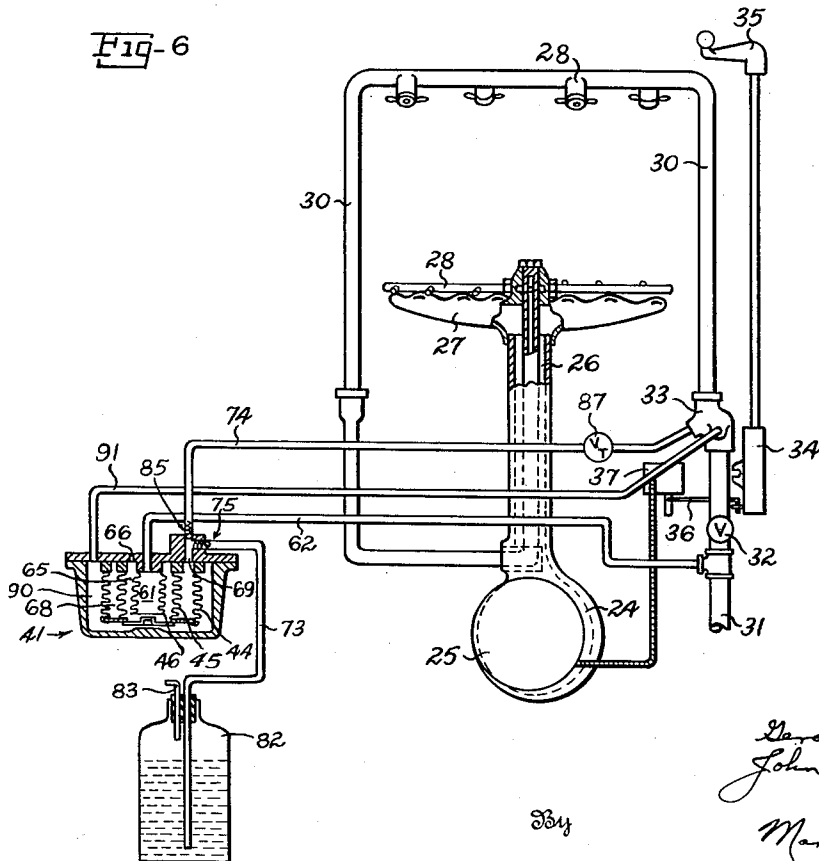


Fig-6



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UNITED STATES PATENT OFFICE

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DISINFECTANT INJECTOR FOR
DISHWASHERS

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7 Claims. (Cl. 299—85)

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This invention relates to the introduction of 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 about 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 often been unsatisfactory.

It is accordingly one of the principal objects of this invention to provide dishwashing equipment which assures 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.

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 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 which 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.

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It is also an object to provide a disinfectant injector for a dishwashing machine having expansion and contraction members which are 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 of the order of about 120° F. to 140° F., the bacteria count will be drastically cut down so that it will be within acceptable public health regulations.

It is another object to provide a compact, inexpensive disinfectant proportioner and injector for a washing machine wherein the alternate expansion and contraction of metallic extendible members or bellows 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 and 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.

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 top elevational view of the disinfectant injecting mechanism;

Fig. 3 is a fragmentary detail view, partly in section, taken on the line 3—3 of Fig. 2;

Fig. 4 is a view similar to Fig. 3 taken on the line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken along the line 5—5 of Fig. 2; and

Fig. 6 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

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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. 6, 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 can be introduced from an outside source, such as a public water supply system for example, and can also be heated from an outside source to a desired temperature. Where the wash and rinse operations are kept separate and independent functions of the machine, the wash fluid is 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 over-flow 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. 6, 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 from neutral provides for starting and stopping the flow of rinse fluid into the arms 28.

It has been found desirable for the reasons 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 phenoxyethoxy ethyl dimethyl benzyl ammonium chloride, cetyl pyridinium chloride, oleyl dimethyl ammonium bromide and like compounds. These compounds are known by such trade names as Roccal, B. T. C., Hyamine, Cepryn, Quartol, etc. It is

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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 Figs. 1, 5 and 6, for introducing the disinfectant into the rinse supply is bolted to a bracket 42 attached at one side of the dishwashing machine. This mechanism in general comprises a casing or housing 43 containing a plurality of extendible bellows type members 44, 45 and 46 of progressively varying sizes concentrically positioned therein which are preferably of metallic construction. These members have their upper ends, as seen in Fig. 5, secured to the under side of the cover plate 47 which in turn is fastened by means of the screws 50 to the housing 43. As shown, the outer and middle members or bellows 44 and 45 have their upper ends secured to the cover plate by means of the screws 51, while the inner member or bellows 46 is formed with its upper end as an integral part thereof. The upper ends of bellows 44 and 45, as well as the upper end of the housing, are provided with seals 52 which may be rubber rings, or of a similar nature, positioned between these members and the cover plate to prevent fluid from leaking between the bellows and from the housing.

The lower ends of the bellows 44 and 45 are joined together by means of the ring 55 which is welded thereto. A circular plate 56 having a raised central portion 57 in contact with the bottom of bellows 46 is welded along its outer periphery to the inner edge of ring 55. The central portion of plate 56 is adapted to seat on the boss 58 formed in the bottom of housing 43 to provide a stop for the lower ends of the bellows.

It will be noted from the construction provided that a plurality of fluid tight chambers or compartments have been formed. One of these chambers 61 comprises the interior of bellows 46 and is provided with a connection through pipe 62 which has one end threadedly received in communication therewith and which extends through the cover plate 47, the other end of pipe 62 being in communication with the rinse supply pipe 31 on the up stream side of valve 32, as shown in Fig. 6.

A second fluid tight chamber or compartment 65 is formed between the bellows 45 and 46. This chamber is provided with an outlet or vent 66 communicating with the atmosphere.

Defined between the bellows 44 and 45 is the third fluid tight chamber or compartment 68. Communicating with this chamber is an aperture 69 formed in the cover plate 47 having communicating passages 71 and 72 extending at right angles thereto, which passages in turn connect with the disinfectant inlet and outlet pipes 73 and 74, respectively, and which have ends threadedly received in the cover plate as illustrated in Figs. 3 and 4.

At one end of the passage 71, Fig. 4, a suction operated disinfectant inlet check valve, generally referred to by the numeral 75, is provided which is adapted to close only the passage 71 when seated. This valve is externally threaded and received within a stepped aperture formed within the cover plate for that purpose and comprises, in general, an elongated body member 76 having its inner end centrally bored to provide a seat for the ball 77 and a recess in which a

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coiled spring 78 is positioned. The outer end of the body member is adapted to receive a sealing ring 79 of rubber or other material suitable to prevent fluid leakage from the interior of the valve, and a lock nut 80 which prevents the valve body from working loose, but which permits the tension of spring 78 to be readily adjusted by moving the body member in or out with respect to the ball 77.

A valve seat insert 81 consisting of a circular collar having a central bore of reduced diameter positioned so as to align with the outer end of passage 71 cooperates with valve 75 and provides an inner seat for ball 77. It will thus be readily apparent that when the ball 77 is not seated on the valve seat insert 81, the passages 69 and 71 are open and in direct communication with the inlet pipe 73, the other end of which is connected to a container 82 which has a supply of disinfectant therein. This container is also provided with a breather or vent pipe 83 in the top so that the disinfectant fluid will be under atmospheric pressure while in the container. When the ball 77 is seated on the insert 81 the passage 71 is closed with respect to passage 69 and communication is no longer maintained through passage 69 and into the inlet pipe 73.

A disinfectant outlet check valve, generally indicated at 85, and constructed similarly to valve 75 is provided in one end of the passage 72. This valve is also externally threaded so as to be received within a step bored aperture provided within the cover plate at substantially right angles to valve 75 as shown in Figs. 2 and 3. The valve parts comprising the ball 86, valve seat insert 88, coiled spring, body member, sealing ring and lock nut, etc. are all similar in construction to the corresponding member in valve 75 and for this reason are not further described. It will be readily apparent with respect to valve 85 that when the ball 86 is not seated on the valve seat insert 88, the passages 69 and 72 are open and in direct communication with the outlet pipe 74, the other end of which is connected through the needle valve 87 into the fitting 33 of the rinse line, and that when the ball is seated on the insert 88 the passage 72 is closed with respect to the passage 69 and communication is no longer maintained through passage 69 and into the outlet pipe 74.

The fourth fluid tight chamber or compartment 90 comprises that area defined between the exterior sides of bellows 44 and the interior of housing 43. This chamber communicates through a pipe 91 threadedly received through the cover plate with the rinse supply pipe 31 by means of a connection with the fitting 33, as illustrated in Fig. 6.

In operating the injector mechanism it will be noted that chamber 61 is in direct communication through pipe 62 with the rinse supply pipe 31 on the upstream side of valve 32 and thus is subjected to line pressure at all times. Chamber 65, adjoining chamber 61, is open to the atmosphere through the vent 66, while chamber 68 adjoining chamber 65 is connected through the suction inlet valve 75 with the inlet line 73 leading to the disinfectant supply container 82 and through the discharge outlet valve 85 with the outlet line 74 communicating through the needle valve 87 into fitting 33 on the downstream side of the rinse supply line 31. Chamber 90 is also connected by means of pipe 91 into the fitting 33 on the downstream side of the rinse supply line 31.

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Thus when the rapid action valve 32 is closed by means of handle 35, chamber 61 is still subjected to line pressure from the rinse supply line 31. This causes the bellows 46 to be fully extended which in turn causes the bellows 44 and 45 to be fully extended likewise since they are connected at their lower ends by the ring 55 and plate 56, and the volume of chamber 68 will be at its maximum. As the bellows are thus expanded when valve 32 is closed, it will be evident that a charge of disinfectant will be drawn up out of the container 82 into pipe 73 and unseat valve 75, which is normally seated or closed, to flow into chamber 68. To accomplish this, the disinfectant fluid which is under atmospheric pressure in the container 82 forces open valve 75. Fig. 4, which is normally closed to the flow of disinfectant through the inlet pipe 73, the passage 71 communicating therewith being closed by the ball 77 which is urged to seat therein by the spring 78. It will be understood that the tension of spring 78 can be adjusted or varied to obtain proper functioning of this valve by turning the valve body 76 as previously described, so that the spring tension will be overcome permitting the valve to open. It will also be apparent that when a charge of disinfectant is expelled from chamber 68 and up through aperture 69, that the pressure of the fluid will be aided, and not opposed, by the tension exerted by spring 78 in holding the ball 77 seated against the insert 81 and thereby closing passage 71 to prevent the disinfectant charge from flowing back down into the container 82.

The charge of disinfectant fluid after being drawn into chamber 68 is discharged up through aperture 69, passage 72, opening valve 85, Fig. 3, by overcoming the opposing tension exerted by the spring and thereby unseating ball 86 to permit the fluid to flow into the outlet pipe 74, which in turn communicates through needle valve 87 into fitting 33 on the downstream side of the rinse supply line valve 32. This flow of fluid into pipe 74 tends to aid spring 78 in closing valve 75 of inlet line 73 so that none of the disinfectant fluid charge is expelled back into container 82, but instead flows directly into the rinse supply line. To accomplish this it will be apparent that the fluid in chamber 68 must be discharged under a pressure which is greater than that existing within the rinse supply line pipe 31. The pressure on the fluid in chamber 68 is greater than that of the rinse supply line since, even when the rapid action valve 32 is open, the upstream pressure of the rinse supply line fluid exists within chamber 61 because of the connection through pipe 62. Chamber 65 is open to the atmosphere, and the somewhat lesser rinse supply line fluid pressure from the downstream side of valve 32 is exerted within chamber 90 through pipe 91. This downstream pressure acting in chamber 90 on the bellows 44, which has the largest effective area, exerts a total pressure force which is sufficient to overcome the total pressure existing within chamber 61 plus that within chamber 68 since the bellows 45 and 46 of these latter chambers are of less effective area than that of bellows 44. A charge of disinfectant is thus forced out of chamber 68 and into the rinse supply line at a pressure greater than that which exists on the downstream side of valve 32.

When the rinse supply line valve 32 is closed, the bellows 44, 45 and 46 are all extended fully since chamber 61 is at all times subjected to line pressure from the upstream side of valve 32.

through pipe 62. The volume of chamber 68 is at its maximum and as all the bellows are fully expanded it will be evident that another charge of disinfectant fluid will be automatically drawn from container 82 to refill chamber 68 which is discharged upon the opening of valve 32 for the next rinse operation.

It will be understood that the fluid being discharged from chamber 68 is under a greater pressure than exists in the rinse supply line 31, pipes 62, 74 and 91 and chamber 90 due to the construction and positioning of the bellows 44, 45 and 46. Thus, it will be apparent also that because the pressure exerted on the fluid in chamber 68 and pipe 74 is greater than the pressure of the rinse fluid, the disinfectant flows from chamber 68 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.

Thus it will be apparent that after chamber 68 has been filled for the first time the subsequent filling and discharge 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 chamber 68, as previously described, is displaced through outlet valve 85 at a rate controlled by the opening in the needle valve 87, 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.

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.

Cross-reference is made to applicants' copending patent application Serial Number 672,961 filed May 29, 1946, and assigned to the same assignee as this application.

While the form of apparatus 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 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 washing machine having rinse outlet means positioned therein, a rinse supply line connected to said rinse outlet means, a valve for controlling the flow of rinse fluid through said rinse line and a supply source of disinfectant, the combination of a disinfectant injector including a first expansible chamber having a pressure responsive wall, means including check valves connecting said first chamber with said supply source and said rinse line, a second expansible chamber having a pressure responsive wall, means con-

necting said walls of said chambers to effect expansion of said first chamber in response to expansion of said second chamber and to effect contraction of said second chamber in response to contraction of said first chamber, means connecting said second chamber with said rinse line on the upstream side of said valve to effect expansion of said first and second chambers each time said control valve is closed, a third expansible chamber having a pressure responsive wall of greater effective area than the combined areas of said walls of said first and said second chambers, means connecting said wall of said third chamber with said wall of said first chamber to effect contraction of said first and second chambers in response to expansion of said third chamber, and means connecting said third chamber with said rinse line on the downstream side of said valve to effect expansion of said third chamber each time said control valve is opened.

2. In a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said rinse outlet means, a valve for controlling the flow of rinse fluid through said rinse line and a supply source of disinfectant, the combination of a disinfectant injector comprising a casing, flexible walls in said casing forming a plurality of expansible chambers of different effective areas, means including check valves connecting a first one of said chambers with said supply source and with said rinse line, means connecting a second of said chambers and said rinse line on the upstream side of said valve to apply line pressure to said one chamber in a direction to effect expansion thereof, means connecting a third of said chambers with said rinse line on the downstream side of said valve to apply line pressure to said third chamber, said third chamber being of greater effective area than the combined effective areas of said first and second chambers, means forming a pressure responsive wall for said first and second chambers within said third chamber for causing contraction of said first and second chambers in response to expansion of said third chamber, and means mechanically connecting said walls of said first and second chambers to cause expansion of said first chamber in response to expansion of said second chamber.

3. In a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said rinse outlet means, a control valve for controlling the flow of rinse fluid through said rinse line and a supply source of disinfectant, a disinfectant injector comprising a casing, a plurality of interfitting bellows mounted in said casing to form separate compartments of different effective areas, means including check valves connecting a first one of said compartments with said supply source and said rinse line, means connecting a second of said compartments and said rinse line on the upstream side of said valve to effect expansion of said second compartment, means connecting a third of said compartments of greater effective area than the combined effective areas of said first and second compartments with said rinse line on the downstream side of said valve to effect expansion of said third compartment upon the opening of said valve, means forming a pressure responsive wall for said first compartment within said third compartment for causing contraction of said first compartment in response to expansion of said third compartment, and means connecting said wall with a wall of said second compartment to

cause expansion of said first compartment in response to expansion of said second compartment.

4. In a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said rinse outlet means, a control valve for controlling the flow of rinse fluid through said rinse line and a supply source of disinfectant, a disinfectant injector comprising a casing, a plurality of interfitting bellows mounted in said casing to form separate compartments of different effective areas, means including check valves connecting an intermediate one of said compartments with said supply source and said rinse line, passages connecting the innermost and the outermost of said compartments with said rinse line on the upstream and downstream sides of said valve respectively, means for venting the interior of said casing between said innermost and said intermediate compartments to the atmosphere, means forming a pressure responsive wall for said intermediate compartment within said outermost compartment for effecting contraction of said intermediate compartment in response to expansion of said outermost compartment, and means connecting said wall with the innermost of said bellows to effect contraction of said innermost compartment in response to contraction of said intermediate compartment and to effect expansion of said intermediate compartment in response to expansion of said innermost compartment.

5. In a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said outlet means, a control valve in said supply line and a separate supply of disinfectant, the combination of a disinfectant injector mechanism comprising a housing, interfitting flexible side walls in said housing forming a plurality of separate fluid compartments adapted for alternate expansion and contraction under pressure of the rinse fluid, an inlet check valve connecting said disinfectant supply with one of said compartments, an outlet check valve connecting said rinse supply line with said one compartment, a connecting passage between a second of said compartments and said rinse supply line on the upstream side of said control valve, a second passage connecting a third one of said compartments and said rinse supply line on the downstream side of said control valve, and means for effecting expansion of said one compartment in response to expansion of said second compartment, said third compartment including a pressure responsive wall of greater effective area than both of said one and second compartments, and means connecting said pressure responsive wall with said side walls of said one compartment and second compartments to cause contraction of said one compartment and second compartment in response to expansion of said third compartment for forcing the disinfectant from said one compartment into said rinse supply line.

6. In a washing machine having rinse outlet means positioned therein, a rinse supply line connected to said outlet means, a control valve in said rinse supply line and a separate supply of disinfectant, the combination of a disinfectant injector mechanism comprising a casing, concentrically positioned extendible bellows members within said casing and forming a plurality of fluid compartments, an inlet check valve connecting said disinfectant supply with one of said compartments, an outlet check valve connecting the same said compartment with said rinse supply line, means connecting a second of said compartments with said rinse supply line on the up-

stream side of said control valve to provide a continuing pressure acting in a direction to expand said second compartment, means connecting a third of said compartments with said rinse supply line on the downstream side of said control valve to provide an intermittent pressure for expanding said third compartment only when said control valve is open, means for effecting expansion of said first compartment in response to the expansion of said second compartment, and said third compartment enclosing said first and second compartments and being of greater effective pressure area to cause contraction of said first and second compartments in response to expansion of said third compartment and thus to effect injection of the disinfectant from said third compartment into said rinse supply line.

7. In a washing 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, the combination of a disinfectant injector comprising a casing, a pair of bellows positioned within said casing in telescoping relation, means joining the free ends of said bellows to form an annular fluid tight inner compartment within said casing and a second compartment between the outer of said bellows and the wall of said casing, means connecting said inner compartment with said disinfectant supply and said rinse supply line on the downstream side of said control valve, a passage connecting said second compartment with said rinse supply line on the downstream side of said control valve to supply line pressure to said second compartment for contracting said bellows, check valve means controlling the flow of said disinfectant to and from said inner compartment, a third bellows positioned internally of said pair of bellows to form a third fluid tight compartment and a space between said inner and third compartments, means connecting said third compartment with said rinse supply line on the upstream side of said control valve to provide line pressure for expanding said third bellows, means connecting said third bellows with said pair of bellows to effect expansion of said inner compartment upon expansion of said third compartment for drawing a charge of disinfectant into said inner compartment, means for effecting contraction of said inner and third compartments upon expansion of said second compartment to force said disinfectant from said inner compartment into said rinse supply line, and means for venting to the atmosphere said space between said inner and third compartments.

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