United States Patent [19]

Camprubi et al.

[11] **3,708,120**

[45] **Jan. 2, 1973**

[54] **FLUIDIC DISHWASHER SPRAY SYSTEM**

[75] Inventors: **Bartholomew Camprubi,** Ickenham; **Grahame Gerald Capron-Tee,** Marlow, both of England

[73] Assignee: **The Hoover Company,** North Canton, Ohio

[22] Filed: **April 6, 1971**

[21] Appl. No.: **131,723**

[52] **U.S. Cl.** .....**239/66,** 239/536, 239/563, 134/56 D, 137/81.5

[51] **Int. Cl.** **B05b 13/02**

[58] **Field of Search**.....239/66, 67, 536, 562, 563, 239/564, 569; 134/191, 176, 179, 56 D, 56 R

[56] **References Cited**

UNITED STATES PATENTS

3,620,050	11/1971	Glasgow	137/81.5 X
1,889,858	12/1932	Greene et al.	239/66
2,596,693	4/1952	Karlstrom	134/56 D
3,373,905	3/1968	Laufer	137/81.5 X
3,447,752	6/1969	Hardy	137/81.5 X
3,513,866	5/1970	Boothe et al.	137/81.5

FOREIGN PATENTS OR APPLICATIONS

1,052,349	12/1966	Great Britain	137/81.5
1,920,575	11/1970	Germany	134/179

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—John J. Love
Attorney—Alfred G. Gross and James A. Wanner

[57] **ABSTRACT**

In the preferred form this invention teaches a dishwasher including a cavity in which dishes are washed, a plurality of stationary spray nozzle groupings arranged in the washing cavity, and a washing fluid supply system to the nozzle groupings, including at least one fluid logic element arranged to sequentially supply washing fluid to the different nozzle groupings.

4 Claims, 4 Drawing Figures

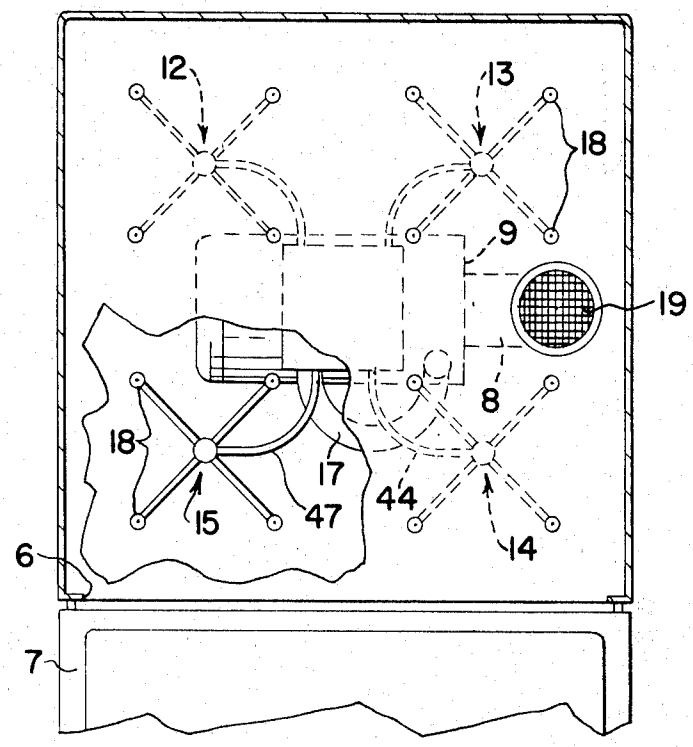


FIG. 1

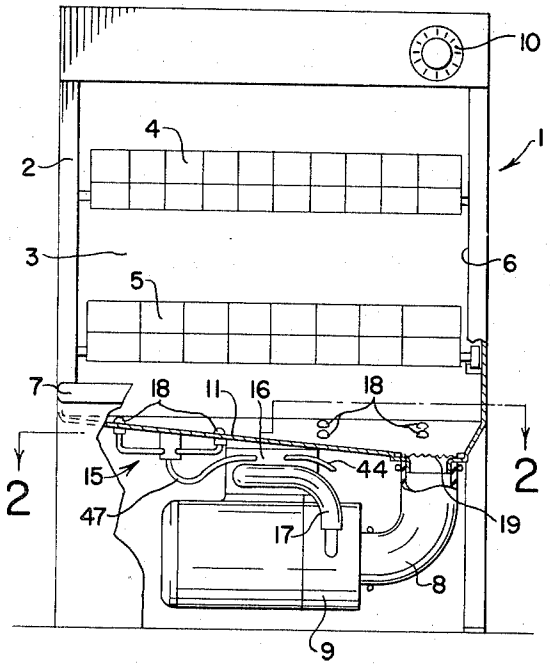


FIG. 2

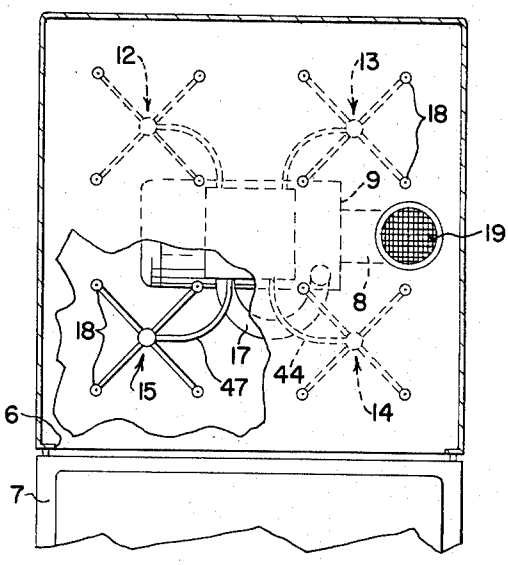


FIG. 3

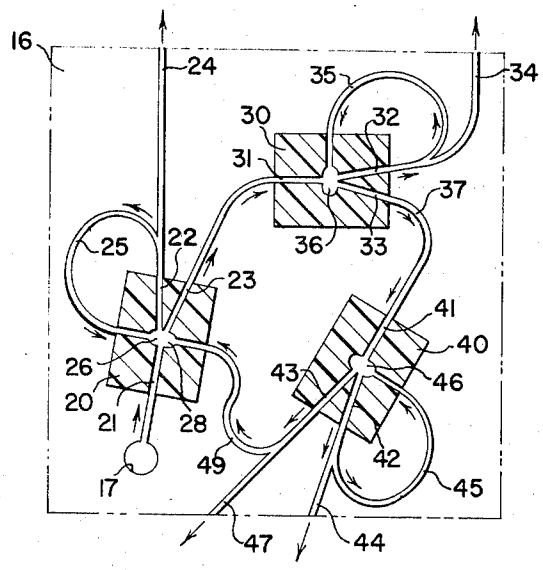
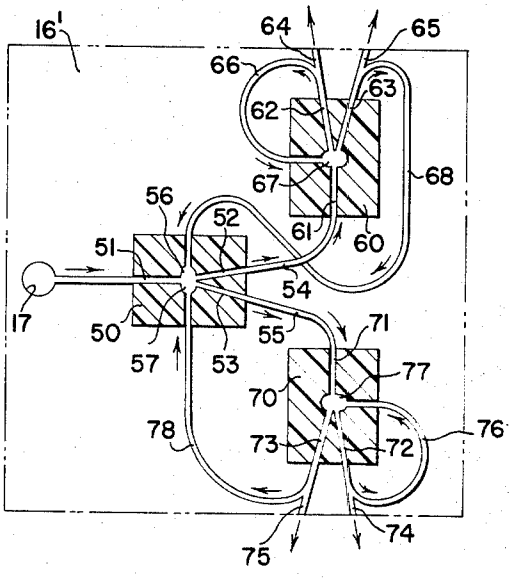


FIG. 4



FLUIDIC DISHWASHER SPRAY SYSTEM

This invention relates to washing machines and in particular to a dishwashing machine. This invention is particularly beneficial in providing a sequential fluid discharge operation through a plurality of stationary supply nozzle groupings in the washing chamber of a dishwasher while using a limited amount of washing fluid and utilizing a limited size pump.

This invention is also beneficial in that the water supply system has a minimum wear and maintenance in that relatively few moving parts are utilized to provide a sequential supply of washing fluid to different spray nozzle groupings.

Many dishwashers utilize rotary spray arm systems to provide spray into different zones within a cavity in which the dishes are washed. A disadvantage of these systems is that the spray arms are mounted for rotary or reciprocating movement, therefore requiring many moving parts involved which are susceptible to wear. A rotary spray arm system has the advantage, however, of using a limited power and water supply system in that only a part of the cavity is being supplied with washing fluid at any one time.

Given unlimited power it is possible to eliminate the movement of spray arms by distributing the washing liquid through a plurality of stationary spray nozzles so as to sufficiently provide washing fluid at all zones within the washing cavity. This not only requires considerably more power but also requires a greater supply of washing fluid.

It is possible to reduce the power requirement and washing fluid quantity requirement in a fixed spray system without using a rotary spray arm, but this generally has required the use of a plurality of mechanically or electrically operated valves which again involves moving parts which are expensive and susceptible to malfunction and therefore create maintenance problems.

According to the present invention, a washing machine including a cavity in which dishes are washed is provided with a plurality of stationary spray nozzle groupings, these groupings being provided with a sequential washing fluid supply. The washing fluid supply system includes at least one, and preferably a plurality of fluid logic devices fed from a common source to provide the sequential supply of washing fluid to the different spray nozzle groupings.

The advantage of such a system is that a limited power supply and a limited washing fluid quantity can be utilized in that only a limited number of spray nozzles are in operation at any one time. Furthermore, the water supply system provides this feature using simple inexpensive elements having no moving parts and thus greatly reduces manufacturing costs and maintenance problems.

Various fluid logic elements may be incorporated. In the preferred form of the invention which is envisioned, a cascade fluid logic system is utilized whereby each spray nozzle grouping has a fluid logic element with which it is associated and utilizes feedback to automatically switch to a further spray nozzle grouping after a predetermined spray period. For this purpose the feedback may be arranged to actuate the fluid logic element through a suitable fluid resistance or capacitor arrangement.

Another advantage of the present invention is that the fluid logic elements may be so arranged so as to provide a spray pattern with relatively even fluid distribution throughout different washing zones within the washing cavity. In the alternative, this system may also be arranged so as to provide different spray pressures within the different washing zones within the cavity. This latter feature is provided by the cascading of the fluid logic elements.

Thus, the present invention teaches a washing fluid supply system for a dishwasher and a spray nozzle groupings within the washing cavity utilizing simple, inexpensive elements having no moving parts and yet requiring only a limited power supply and limited supply of washing fluid.

In the drawings:

FIG. 1 is a fragmentary elevational view showing a dishwasher utilizing the washing fluid supply arrangement of the present invention;

FIG. 2 shows a cross-sectional view of the dishwasher taken along the lines 2—2 of FIG. 1, showing a typical spray nozzle arrangement;

FIG. 3 shows an enlarged view of the fluid control system utilized to supply washing fluid to the spray nozzle arrangement of FIG. 2; and

FIG. 4 shows a modification of the fluid supply control system which may also be used to supply washing fluid to the spray nozzle arrangement of FIG. 2.

In the preferred form, the present invention may be carried out in a dishwashing machine such as that generally shown in FIG. 1. The dishwashing machine has a cabinet 2 which generally defines an internal washing cavity 3 into which dishes and other articles to be washed are placed. These articles can be arranged on racks 4 and 5 located within the washing cavity 3. These racks may be removable through access opening 6 normally closed by a door 7.

As shown in FIGS. 1 and 2, the dishwasher is provided with a sump 8 having a filter 19 which feeds a motor-driven pump 9 which are included in the preferred form to provide a recirculating spray of water for washing articles within the cavity 3. Water may be supplied to the washing cavity by any conventional manner, such as a water supply hose controlled by solenoid valves (not shown).

The dishwashing machine may be provided with a conventional timer and control knob generally indicated by 10 which controls the fill solenoid and pump for timed operation.

As shown in FIG. 2 the floor 11 of the washing cavity is provided with four stationary spray nozzle groupings 12, 13, 14 and 15. Each of these stationary spray nozzle groupings contain four spray nozzles 18 which are generally aimed upwardly into the washing cavity. It is within the intent of the present invention to utilize fewer or more spray nozzles located solely within the cavity floor or arranged elsewhere within the cavity such as on the sides and top thereof.

Each of these groupings 12, 13, 14 and 15 contains a separate feed line connected to the spray control unit 16 supplied from a common central source such as the pump 9. A washing fluid under pressure is sequentially fed to the stationary spray nozzle groupings by the spray control unit 16 which contains at least one fluid logic element, such as elements 20, 30 and 40.

The spray control unit **16** is shown enlarged in FIG. **3**. Pressurized washing fluid leaving the pump **9** enters the spray control unit through a conduit **17**. Directly fed by the conduit **17** is inlet **21** of the first fluid logic element **20**. The fluid logic element **20** is also provided with two outlets **22** and **23**. The first of these outlets **22** feeds the stationary spray nozzle grouping **12** through conduit **24**. Also provided is a feedback line **25** interconnecting the conduit **24** with a first control port **26** within the fluid logic element. The fluid logic element is also provided with a second control port **28** whose purpose will be later explained.

The other outlet **23** of the first fluid logic element **20** is connected by means of conduit **27** to the inlet **31** of the second fluid logic element **30**. This fluid logic element **30** is provided with outlets **32** and **33**. The outlet **32** supplies a conduit **34** which feeds the second stationary spray nozzle grouping **13**. Also associated with this fluid logic element **30** is a feedback line **35** interconnecting the conduit **34** and a first control port **36** of the fluid logic element **30**.

The second outlet **33** feeds a conduit **37** which is connected to the inlet **41** of the third fluid logic element **40**. Again, this fluid logic element **40** has two outlets **42** and **43**. The outlet **42** feeds a conduit **44** to supply the stationary spray grouping **14**. A feedback line **45** interconnects the conduit **44** with a first control port **46** of the fluid logic element **40**. The outlet **43** feeds a conduit **47** associated with spray nozzle grouping **15**. Also associated with the outlet **43** and the conduit **47** is a feedback line which is associated with the second control port **28** of the first fluid logic element **20**.

It is noted that the spray control unit **16** as above described contains no electrical or mechanical moving parts. However, this control unit can sequentially supply washing fluid to the four stationary spray nozzle groupings **12, 13, 14** and **15** as will now be described.

Washing fluid may be supplied to the cavity **3** through a conventional means not shown. Once a sufficient amount of washing fluid has been supplied the timer **10** may start operation of the motor-driven pump **9** so as to draw the washing fluid from the sump **8** and thus feed conduit **17**. Pressurized washing fluid will enter the fluid logic element **20** through inlet **21**. The washing fluid will leave the fluid logic element **20** through outlet **22** and conduit **24** to feed the first spray nozzle grouping **12**.

Once sufficient pressure has been provided to conduit **24** and also the feedback line **25**, the feedback will act at the first control port **26** so as to switch fluid flow from outlet **22** to outlet **23** so as to feed the fluid logic element **30** through conduit **27**. The fluid logic element **20** and all the other fluid logic elements herein described are bistable or flip-flop fluid logic elements.

The fluid flow through the second fluid logic element **30** will first feed the fluid spray nozzle grouping **13** through outlet **32** and conduit **34** until sufficient pressure is developed in feedback line **35** and control port **36** so as to switch fluid flow to outlet **33**. The outlet **33** feeds the third fluid logic element **40** through conduit **37** and inlet **41**.

The fluid flow through the fluid logic element **40** will feed the stationary spray nozzle grouping **14** through conduit **44** until sufficient pressure is developed in feedback **45** and control port **46** so as to switch the fluid flow through outlet **43** and conduit **47** so as to feed the last stationary spray nozzle grouping **15**.

When sufficient pressure has been developed in conduit **47** and therefore feedback line **49**, this pressure will act at the fluid control port **28** of the first fluid logic element **20** so as to again provide flow through the outlet **22**. The first fluid logic element will provide flow through line **23** until sufficient pressure has been developed at the second control port **28** since the fluid logic elements are bistable.

This process will be continued in a repeated fashion so as to sequentially feed the stationary spray nozzle groupings **12, 13, 14** and **15** until the timer stops the pressurized fluid flow through conduit **17** by de-activating the motor-driven pump **9**.

It should be noted that the fluid logic elements as shown in FIG. **3** and above described are cascaded or connected in series relationship. Since there is a certain pressure loss through each fluid logic element, a greater pressure will be provided at the outlets of fluid logic element **20** than is provided at the outlets of fluid logic elements **30**. Furthermore, greater pressure will be provided at the outlets of fluid logic element **30** than the outlets of fluid logic element **40**. Therefore, the fluid pressure at the spray nozzle groupings **14** and **15** will be less than the pressure at spray nozzle grouping **13** which will be less than the pressure at the spray nozzle grouping **12**.

This is provided due to the series relationship of the fluid logic elements and is desirable if the dishwashing machine is designed so as to have higher spray pressures within certain washing zones than the other washing zones. This might be desired if pots and pans are placed in an area above the spray nozzle grouping **12** which could be called a high pressure zone. More fragile articles, such as china, could be placed in an area over the spray nozzle groupings **14** and **15** which could be called a low pressure zone.

A modification of the spray control unit **16** shown in FIG. **3** is shown in FIG. **4** and indicated as spray control unit **16'**. The spray control unit **16'** is also provided with a conduit **17** connected to the pump **9**. A first fluid logic element **50** is fed from the conduit **17** through inlet **51**. Element **50** has two outlets **52** and **53** which feed two other fluid logic elements **60** and **70** through conduits **54** and **55** respectively. Also associated with the fluid logic element **50** are first and second control ports **56** and **57**.

The second fluid logic element has an inlet **61** associated with the conduit **54** of outlet **52** of the first fluid logic element **50**. The fluid logic element **60** has outlets **62** and **63** associated with conduits **64** and **65** which feed the stationary spray nozzle groupings **12** and **13** respectively.

Also associated with conduit **64** is a feedback line **66** connected to a control port **67** of the second fluid logic element **60**. Associated with conduit **65** and connected to the first control port **56** of the first fluid logic element **50** is a feedback line **68**.

A third fluid logic element **70** has an inlet **71** in communication with conduit **55** fed by the second outlet **53** of the fluid logic element **50**. The fluid logic element **70** has outlets **72** and **73** which feed conduits **74** and **75** so as to supply washing fluid to the stationary spray nozzle

groupings **14** and **15** respectively. Associated with the conduit **74** and a control port **77** is a feedback line **76**. Associated with conduit **75** and the second control port **57** of the fluid logic element **50** is a feedback line **78**.

The washing fluid control unit **16'** operates along the same general lines as the control unit **16** in that it utilizes no electrical or mechanical moving parts but is able to provide a sequential fluid supply to the stationary spray nozzle groupings. However, in the modification **16'** the two fluid logic elements **60** and **70** associated with the spray nozzle groupings are in parallel relationship with each other and in series relationship with the fluid logic element **50**. Again, bistable or flip-flop fluid logic elements are utilized to provide the sequential spray pattern. The operation of the spray unit **16'** will now be described.

Pressurized washing fluid provided through conduit **17** will enter the fluid logic element **50** through inlet **51** and leave through outlet **52** and conduit **54** to feed the fluid logic element **60** through inlet **61**. The washing fluid will then leave the fluid logic element **60** through outlet **62** and conduit **64** to feed the spray nozzle grouping **12** until sufficient pressure is developed in feedback line **66** and control port **67** so as to switch the fluid flow through outlet **62** to outlet **63**.

The fluid flow will then leave the fluid logic element **60** through outlet **63** and conduit **65** to provide a washing fluid supply to spray nozzle grouping **13** until sufficient pressure is developed in feedback line **68** and the first control port **56** of the fluid logic element **50**. At this point the fluid flow through fluid logic element **50** is switched from outlet **52** to outlet **53** so as to feed the third fluid logic element **70** through conduit **55**. The fluid logic element **70**, in a similar manner to the element **60**, provides fluid supply through outlets **72** and conduits **74** to the spray nozzle grouping **14** until sufficient pressure is developed in feedback **76** and port **77** so as to switch the fluid flow from outlet **72** to outlet **73**.

Fluid flow will now be provided through outlet **73** and conduit **75** so as to feed spray nozzle grouping **15** until sufficient pressure is developed in feedback line **78** and the fluid control port **57** of the first fluid logic element **50**. At this point the fluid flow through fluid logic element **50** will be switched from outlet **53** to outlet **52**, so as to again provide washing fluid to the fluid logic element **60**.

This will be continued in a repeated fashion so as to provide sequential switching of the washing fluid to the spray nozzle groupings **12, 13, 14** and **15** until operation of the pump **9** has ceased.

It is noted that in this arrangement that the two fluid logic elements **60** and **70** which feed the spray nozzle groupings **12, 13, 14** and **15** are in parallel relationship to each other and in series relationship with the fluid logic element **50**. Thus, a substantially equal fluid pressure will be provided through the outlets **62, 63, 72** and **73** so as to provide relatively equal spray pressure at the four stationary supply nozzle groupings.

It is noted that the spray control units **16** and **16'** use fluid logic elements and associated feedback lines to provide the sequential control of the washing fluid. The feedback control elements automatically switch the washing fluid from one spray nozzle grouping to another after a predetermined spray period.

If it is desirous to lengthen the predetermined spray period, it may be advantageous to associate a suitable fluid resistance or capacitator delay arrangement known in the fluid logic element art with each of the feedback lines.

As shown in FIG. **2** each of the spray nozzle groupings is provided with four stationary spray nozzles. This is merely shown to indicate one arrangement of the spray nozzles. Spray nozzles could also be located on the sides and top of the washing cavity. Furthermore, if it is desired, only one spray nozzle need be provided for each spray nozzle grouping. If a greater or lesser number of spray nozzle groupings are desired, an appropriate number of fluid logic elements must be provided accordingly.

The foregoing is but the preferred forms of practicing the present invention. The invention is not limited to the particular details or modifications shown and described. It is, therefore, intended that the claims below will cover all modifications which will occur to those skilled in the art and do not depart from the scope and spirit of the invention.

We claim:

1. A washing machine comprising a cabinet defining a cavity for washing articles, a plurality of spray nozzle groupings each having at least one spray nozzle within said cavity, and a washing fluid spray system for sequentially providing a supply of washing fluid to said spray nozzle groupings, said washing fluid supply system comprising a pressurized fluid source, a plurality of fluidic logic elements, a first spray nozzle grouping associated with one of said fluidic logic elements, another spray nozzle grouping associated with another fluidic logic element, and a feedback circuit interconnecting at least two of said fluidic logic elements, whereby said interconnection between said fluidic logic elements causes automatic switching of said fluid supply to said other spray nozzle grouping upon a sufficient rise of fluid pressure in said first fluidic logic element causing control pressure through said feedback circuit.

2. A washing machine comprising a cabinet defining a cavity for washing articles, a plurality of spray nozzle groupings each having at least one spray nozzle within said cavity, and a washing fluid supply system for sequentially providing a supply of washing fluid to said spray nozzle groupings, said washing fluid supply system comprising a pressurized fluid source and a plurality of fluidic logic elements connected in a series relationship, each of said fluidic logic elements having at least one output, and an output of each of said fluidic logic element in said series relationship being in direct fluid flow connection with at least one of said spray nozzle groupings.

3. The washing machine of claim **2** wherein a feedback circuit is provided interconnecting at least two of said fluidic logic elements so as to provide stepped sequential supply of washing fluid to different spray nozzle groupings.

4. The washing machine of claim **2** wherein said cavity defined by said cabinet is provided with a plurality of washing zones, each of said spray nozzle groupings providing a spray pattern in at least one of said washing zones whereby different fluid pressures are provided in different zones.

* * * * *