



March 5, 1946.

H. E. S. HIORT AF ORNÄS

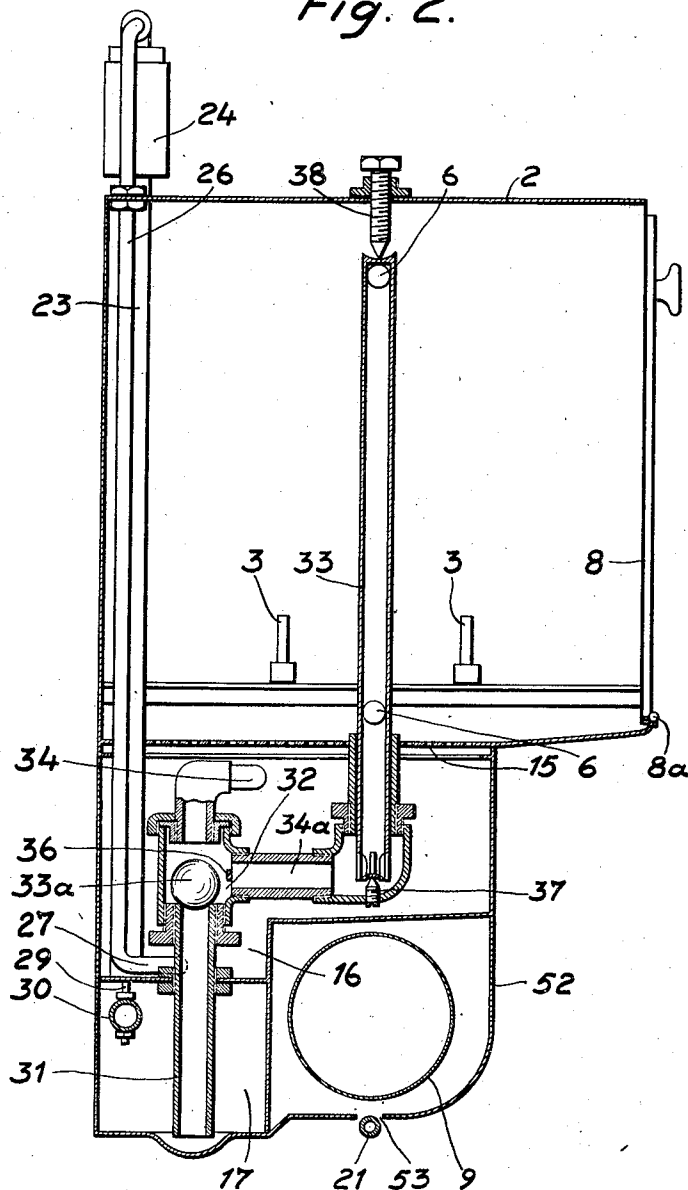
2,395,968

DISHWASHER

Filed April 29, 1942

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Fig. 2.



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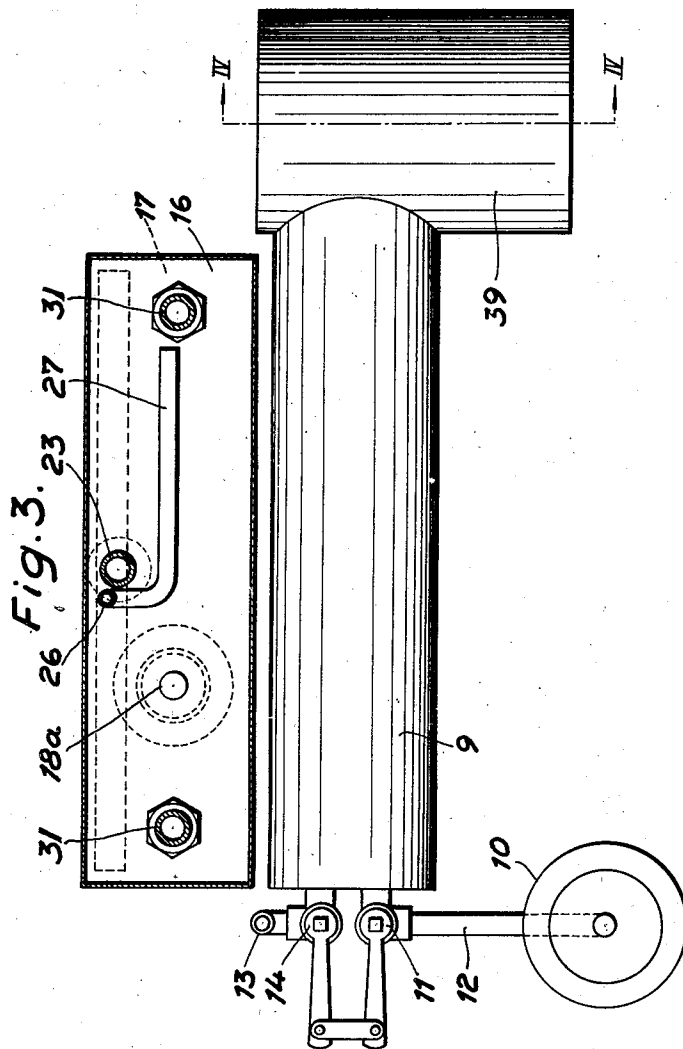
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DISHWASHER

Filed April 29, 1942

4 Sheets-Sheet 3



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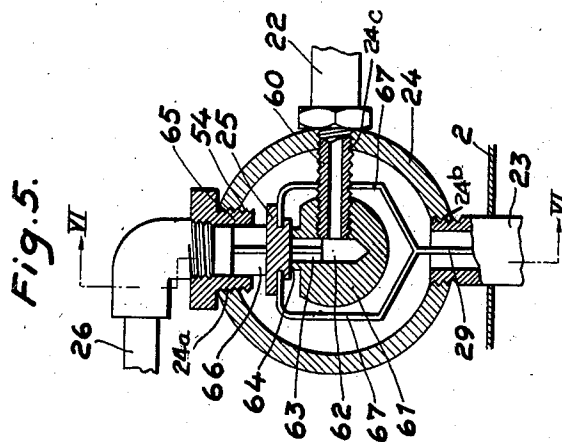
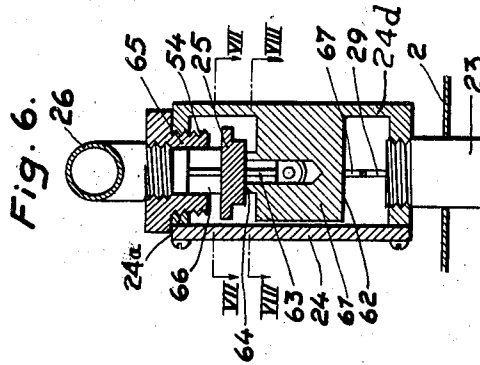
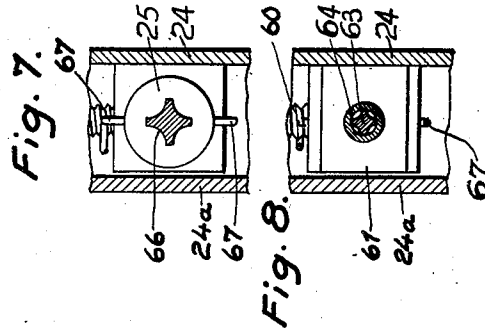
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DISHWASHER

Filed April 29, 1942

4 Sheets-Sheet 4



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## UNITED STATES PATENT OFFICE

2,395,968

## DISHWASHER

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Stockholm, SwedenApplication April 29, 1942, Serial No. 440,905  
In Sweden December 31, 1937

7 Claims. (Cl. 134—56)

The present invention relates to a dish washer in which the washing liquid is circulated through steam pressure. One object of the invention is to produce a dish washer of the type in which after the dishes have been washed with circulating suds for a certain length of time, an automatic rinsing with hot clear water is effected.

Another object of the invention is to derive the steam for the circulation of the suds and the hot rinsing water from one and the same water tank.

A still further object of the invention is to effect a heating of the circulating suds by means of exhaust or waste steam.

These and other objects, which will appear more clearly, as the specification proceeds, are accomplished according to the invention by the arrangement and combination of elements set forth in the following detailed description and defined in the appended claims.

An embodiment of the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a vertical section of the dish washer; Figure 2 is a section on the line II—II of Figure 1.

Figure 3 is a section on the line III—III of Figure 1 with certain parts omitted, in which also the steam generator is shown from above;

Figure 4 is a section on the line IV—IV of Figure 3;

Figure 5 is a vertical section on a larger scale through the valve and valve casing on top of the dishwasher shown in Fig. 1;

Figure 6 is a section taken on line VI—VI of Fig. 5; and

Figures 7 and 8 are sections taken on lines VII—VII and VIII—VIII, respectively, of Fig. 6.

On the drawings, the reference numeral 2 indicates the washing chamber itself. Frames for the articles to be washed are indicated by 3 and the articles by 4. The sprinkler consists of turnably mounted pipes 6 having apertures 5 for the passage of the water. The sprinkler rotates in the manner of a reaction water wheel when liquid is pressed into the pipes 6 and discharged through apertures 7 provided therein. Access to the washing chamber is obtained through a cover or door 8 turnable on hinges 8a, said cover being adjustable to the desired position relatively to the vertical plane by means of a link device or the like.

9 indicates a steam generator or steam boiler, which is filled with feed water through a funnel 10. The funnel and the steam generator are connected with each other through a supply pipe 55

12 regulated by a cock 11. To control the feed water quantity, i. e. the water level of the generator, said generator can suitably be connected with a riser pipe 13, to which the water supply is controlled by a second cock 14 coupled in parallel with the cock 11. When the cock 11 is being closed, the cock 14 is consequently closed too.

The washing liquid is fed into the washer through the cover 8 and then passes through the straining means 15 to a collecting chamber 16 located below said straining means from which chamber it continues to a pressure chamber 17, through an opening 18a made in the bottom of the collecting chamber and regulated by a ball valve 18. The ball of this valve is lighter than water and, while it is pressed away by the liquid entering the pressure chamber 17, it is guided by guiding pins 19 so that, when the pressure chamber is filled with washing liquid, the ball presses tightly against the opening 18a.

20 indicates a gas cock regulating the gas supply to an elongated multi-outlet burner 21 which is provided with a pilot light, so that, when the gas cock is opened, the gas at all the outlets of the burner is at once ignited.

A valve casing 24 is arranged on top of the washing chamber 2. As shown in Figs. 5 to 8, the valve casing has the shape of a substantially cylindrical flat drum and is provided with three radial screw-threaded ports 24a, 24b and 24c, at the top, the bottom and one side, respectively, of the casing. A valve body 61, which is integral with one end wall 24d of the casing 24, is disposed centrally in the casing and provided with a vertical recess 62 disposed below the top port 24a. A steam pressure pipe 22 extends from the steam chamber of the steam generator 9 to the lateral port 24c of the casing 24 and is connected to the recess 62 in the valve body 61 by means of a screw threaded tube 60 having one end screwed into the port 24c and the other end into a transverse threaded bore of the valve body 61. A straight vertical connecting pipe 23 is screwed with its upper end into the bottom port 24b of the casing 24 and opens at its lower end into the pressure chamber 17. A flanged bushing 65 is screwed into the top port 24a of the casing 24 to receive one end of a steam exhaust pipe 26, the other end of which is formed with a bent end portion provided with a plurality of apertures 28 and located in the lower portion of the collecting chamber 16. A disc-shaped valve 25 is seated on a valve seat 64 formed by a raised rim on the upper edge of the recess 62, said valve being guided in the recess 62 and in the bush-

ing 65 by means of valve rods 63 and 66, respectively, which are provided with radial guide ribs (see Figs. 7 and 8). The valve 25 is supported by a fork 67 which surrounds the valve body 61 and is integral with the upper end of a straight vertical rod 29. The rod 29 passes through the connection pipe 23 and has its lower end fixed to a float 30 disposed in the pressure chamber 17, so as to lift the rod 29 and fork 27 and to displace the valve 25 upwardly from its seat 64 when the pressure chamber is filled with water.

The valve 25 and rod 29 are so dimensioned that, as long as the rod 29 has not assumed its uppermost position, even the maximum steam pressure in the pipe 22 and recess 62 is incapable of displacing the valve 25 from its normal position shown. As soon, however, as the rod 29 rises to its uppermost position and the valve 25 has been dislodged from its seat 64, the steam rushing out from the recess 61 acts upon the entire lower surface of the valve 25 and lifts the latter to a position in which its upper surface seats against the rim of the bushing 65. This position of the valve 25, in which the connection between the steam chamber of the steam generator 9 and the pressure chamber 17 is established and the inlet from the valve casing 24 to the exhaust pipe 26 is closed, is thereafter maintained, even if the level of the water in the pressure chamber 17 drops to a point where the rod 29 is no longer held in its uppermost position by the float 30, until the pressure of the steam passing through the casing 24 falls below a predetermined limit.

The pressure chamber 17 can further communicate with the washing chamber 2 by means of two liquid pressure pipes 31 opening into the bottom of the pressure chamber, each of said pipes opening into its individual valve casing 32, in which is located a ball 33a, the specific gravity of which is greater than 1, and which allows washing liquid of a certain pressure to pass from the liquid pressure pipe 31 to the valve casing 32. The valve casing communicates with the turnable riser pipe 33 of the sprinkler 5, 6 through the sprinkler pipe 34a as well as with a discharge pipe 34 of the steam generator. This pipe is controlled by a valve 35 in the tank 39. In order to prevent the ball 33a from shutting off the supply to the riser pipe 33, there is a guiding pin 36. The riser pipe 33 is easily turnable on pivots 37, 38. The pivot 38 is preferably adapted to be tightened.

In the embodiment shown, one end portion of the steam generator is formed with a cylindrical tank 39, forming a right angle with the remaining part of the generator and having a somewhat greater diameter than the generator. The steam pressure pipe 22 and the discharge pipe 34 open into this tank 39. In the tank 39, there is located a two-armed lever 40 turnable around a pivot 41 fixed to a bracket 42. One arm of the lever 40 carries a float 43. The other arm is connected with the valve 35 by means of a link 44 and also with a piston 46 which by means of a link 45 is displaceable in a cylinder 48 provided with apertures 47 connecting the interior of the tank 39 with the steam pressure pipe 22. A regulating device 50 for the gas supply, which is responsive to the steam pressure in the generator, is disposed on top of the tank 39.

In the gas pipe leading to the burner 21, there is provided a diaphragm valve 57 of known construction with a valve chamber subdivided into an upper and a lower room by means of a hori-

zontal diaphragm. The gas stream flowing to the burner 21 passes through the lower room which is connected with the upper room by a leak passage. A leak pipe 50a leads from the upper room of valve 57 to the regulating device 50 from which the leakage gas is normally discharged through a discharge pipe 50b terminating at the burner 21. The interior of a bellows 50c located in the regulating device 50 communicates with the tank 39 through a conduit 50d and is adapted to close the outlet from the regulating device 50 to the discharge pipe 50b when the bellows 50c is expanded to a certain extent.

As long as the steam pressure in the tank 39 is below a predetermined limit, the gas pressure in the lower room of the diaphragm valve is kept above that in the upper room of said valve, because the gas leakage into the upper room is constantly discharged through the pipes 50a, 50b and burns with a small flame at the burner end of the discharge pipe 50b. Under these circumstances the flow of gas through the lower room of the valve 57 to the burner 21 is unimpeded. When the steam pressure in the tank 39 exceeds the predetermined limit, it acts through the conduit 50d on the bellows 50c and dilates the latter so as to close the outlet to the discharge pipe 50b. As a result, gas pressure is gradually built up in the device 50, leak pipe 50a, and upper room of the diaphragm valve 57. When this pressure has reached a certain value, the pressure existing in the lower room of valve 57 is no longer sufficient to support the diaphragm, the latter is lowered and turns down the flow of gas from the lower room to the burner 21 sufficiently to prevent further heating of the water contained in tank 9. When the steam pressure falls, the outlet from the device 50 to the discharge pipe 50b is opened again, the pressure in leakage pipe 50a and in the upper room of the valve 57 is rapidly decreased and the gas pressure in the lower room of valve 57 raises the diaphragm so as to restore the full flow of gas to the burner 21.

To the other arm of lever 40, there is further fixed a third link 49, which guides the bellows 50c to a position to close the outlet to 50b, when the feed water has sunk beneath a certain level. 51 indicates a safety valve.

In front of the generator is located a protective casing 52 so that the warm gases produced by the gas flame shall be retained at, and guided towards the generator. The gas burner 21 is preferably placed immediately outside a slot 53 made right under the generator in the lower portion of the casing.

Suitable packings are provided between the various elements wherever necessary.

The dish washer operates in the following manner:

The feed water is fed into the generator 9, 39 to a suitable height, which is read on the riser pipe 13. The air pressed away escapes through the cock 14 and the riser pipe 13. Then the washing liquid is fed through the cover 8. The washing liquid flows through the strainer 15 to the collecting chamber 16 and hence through the aperture 18a in the bottom of the latter into the pressure chamber 17. The ball 18 controlling the opening 18a is pushed away by the water entering the pressure chamber 17. So much liquid is preferably introduced that the whole pressure chamber 17 and the lower portion of the collecting chamber 16 are filled. Now, the ball 18 is pressed tightly against the opening 18a. The articles to be washed are placed into the

washing chamber. Then the gas cock 20 is opened, whereby the gas burner 21 is ignited by means of the pilot light.

The steam produced in the steam chamber of the generator 9, 39 passes to the steam pressure pipe 22 through the apertures 47 which have been set free by the piston 46 in the present, high, position of the float 43. At the end of the steam pressure pipe 22, the steam presses upon the valve 25, which is also influenced by the upwards directed pressure of the float 30 in the washing liquid. When these two pressures have become so great that the valve is lifted towards the seat 54 at the outlet of the steam exhaust pipe 26, the steam flows through the connection pipe 23 and presses the washing liquid upwards through the liquid pressure pipes 31 against the action of the ball 33a into the rise pipes 33 and the sprinklers 6, which now begin to rotate. During this pumping process ball 18 presses tightly against the opening 18a and the ball 33a is urged against the outlet of the discharge pipe 34. Moreover, the valve 35, which is actuated by the steam pressure and the pressure of the float, prevents under all circumstances the liquid from entering into the generator. When all the washing liquid has been pressed out from the pressure chamber 17, the steam will rush out through the sprinkler, whereby the steam pressure in the valve casing 24 drops to such an extent that the valve 25 falls from its seat 54. Thus, the aperture of the pipe 26 is set free and the outlet of the steam pressure pipe 22 in the valve casing is closed. Simultaneously, as the valve 25 falls and the pressure in the pressure chamber drops substantially to atmospheric pressure, the ball 18, is also pressed down by the washing liquid so that said liquid in the collector chamber 16 flows down into the pressure chamber 17 whereby the steam in the latter is pressed out through the connection pipe 23 to the casing 24 and from there through the steam exhaust pipe 26 to the bottom of the collecting chamber, where, when escaping it heats the washing liquid. The pressure chamber having been almost filled, the float 30 helps lifting the valve 25, whereupon the pumping process starts again. The procedure now described is repeated for some time, the washing liquid being successively heated by the steam until so much feed water has left the generator in the form of steam and been condensed in the washing liquid that the float 43 floating on the feed water has sunk so much that the valve 35 is lifted from its seat. This successive heating of the washing water preserves the dishes so that cracks are avoided; furthermore, a fully satisfactory washing is obtained in this way, as some of the substances on the dirty dishes are removed at a lower and some at a higher temperature.

When the valve 35 is lifted the hot feed water rushes out from the generator due to the pressure, the level of the water consequently sinks very rapidly and the float 43 is lowered very suddenly so that the piston 46 at once closes the steam outlet apertures 47 for the steam pressure pipe 22. Simultaneously the link 49 actuates the control device 50 for the gas supply so that this is positively interrupted and the gas burner is extinguished. The feed water is now pressed through the discharge pipe 34 into the valve casing 32, the ball 33a closes the liquid pressure pipe 31 to the pressure chamber 17, and therefore the water is forced out to the sprinkler

so that the articles to be washed are very strongly sprinkled with hot water.

The water in the washing chamber is drawn off through the outlet cock 55. The feed water in the generator may also be drawn off through a cock located at 56.

Of course, the invention is not limited to the above shown embodiment, but its details may be varied within the scope of the appended claims. Any heating agent may be used. The discharge pipe 34 from the generator need not be coupled to the sprinkler, but a separate outlet may be provided for the washing water. However, the shown embodiment seems to be most suitable since the number of the pipes is reduced and an efficient rinsing by the sprinkler is obtained. The shown dish washer is provided with two sprinklers, but there may be one or several. The shape and location of the generator may vary as well as its control means. For example, the lever 40 may be one-armed.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a dishwasher, the combination with a washing chamber and steam pressure operated means for circulating washing liquid through said washing chamber, of a separate steam generator including a water tank adapted to be heated, said tank being provided with a steam discharge port in its upper portion and with a water discharge port in its lower portion, steam conducting means connecting said steam discharge port with said steam pressure operated washing liquid circulating means, water conducting means connecting said water discharge port with said washing chamber, and means closing said water discharge port as long as the water in said tank does not fall below a predetermined level, said means being adapted to open said water discharge port when the water in said tank falls below said level.

2. A dishwasher combination, as claimed in claim 1, including heating means for said steam generator, means associated with said water tank to shut off said heating means when the steam pressure in said water tank exceeds a predetermined maximum, and means associated with said water tank to shut off said heating means when the water in said tank falls below a predetermined level.

3. In a dishwasher, the combination with a washing chamber, a pressure chamber disposed below said washing chamber and communicating therewith through a port in the upper part of said pressure chamber, means for closing said port when the liquid in said pressure chamber rises above a predetermined level and for keeping it closed when the liquid drops below said level as long as the steam pressure in said pressure chamber exceeds a predetermined limit and a riser pipe extending substantially from the bottom of said pressure chamber upwardly into said washing chamber, of a separate steam generator including a water tank adapted to be heated, said tank being provided with a steam discharge port in its upper portion and with a water discharge port in its lower portion, steam conducting means connecting said steam discharge port with the upper part of said pressure chamber, water conducting means connecting said water discharge port with said washing chamber, and means closing said water discharge port and opening said steam discharge port as long as the water in said tank does not fall below a

predetermined level, said means being adapted to open said water discharge port and to close said steam discharge port when the water in said tank falls below said level.

4. A dishwasher combination, as claimed in claim 3, in which said water conducting means includes a valve casing inserted in said riser pipe, a connecting pipe between said water discharge port and an inlet port in said valve casing, and a valve in said valve casing to close the part of said riser pipe below said valve casing when water flows through said connecting pipe into the valve casing and to close said inlet port when water is pressed upward in the lower part of said riser pipe.

5. A dishwasher combination, as claimed in claim 3, in which said steam conducting means includes a valve casing, a pressure pipe connecting said steam discharge port with an inlet in said valve casing, an inlet valve seat of predetermined cross-section in said valve casing in communication with said inlet, an exhaust valve seat of larger cross-section in said valve casing opposite said inlet valve seat and in communication with an outlet, a valve in said valve casing between said two valve seats and normally seated on and closing said inlet valve seat, a steam conducting pipe connecting said valve casing with said pressure chamber, and means causing said valve to be lifted off said inlet valve seat and to be seated on said exhaust valve seat when said pressure chamber is filled with washing liquid beyond a certain level, whereby said inlet remains open when the liquid in said pressure chamber drops below said level as long as the steam pressure in said chamber and in the valve casing exceeds a predetermined limit.

6. A dishwasher combination, as claimed in claim 3, including a washing liquid collecting chamber interposed between said washing chamber and said pressure chamber, and a steam exhaust pipe having one end disposed near the bot-

5 tom of the collecting chamber to discharge exhaust steam into the washing liquid contained therein, said steam conducting means including a valve casing having an outlet port connected to the other end of said steam exhaust pipe, an exhaust valve seat of a predetermined cross-section in said valve casing in communication with said outlet port, a pressure pipe connecting said steam discharge port of said water tank with an inlet in said valve casing, an inlet valve seat of smaller cross-section than said exhaust valve seat disposed in said valve casing opposite the latter and communicating with said inlet, a valve in said valve casing between said two valve seats and normally assuming a position in which it is seated on said inlet valve seat and said outlet port is open, a steam conducting pipe connecting said valve casing with said pressure chamber, and means causing said valve, when said pressure chamber is filled with washing liquid beyond a certain level, to assume a second position in which it is seated on said exhaust valve seat and said inlet is open, whereby said valve, after assuming said second position, remains therein when the liquid in said pressure chamber drops below said level as long as the steam pressure in said chamber and in the valve casing exceeds a predetermined limit.

7. A dishwasher combination, as claimed in claim 3, including heating means for said steam generator, means associated with said water tank to shut off said heating means when the pressure in said water tank exceeds a predetermined maximum, and means associated with said water tank to shut off said heating means when the water in said tank falls below a predetermined level lower than that at which the steam discharge port is closed and the water discharge port is opened.

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