

[54] **DISHWASHER WITH ENERGY RADIATING HEAT LAMPS**

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[51] Int. Cl.² **B08B 1/10**

[58] Field of Search **134/57 D, 58 D, 113, 105, 134/107, 108; 250/494, 495, 504; 313/113; 34/4, 1; 240/103 R**

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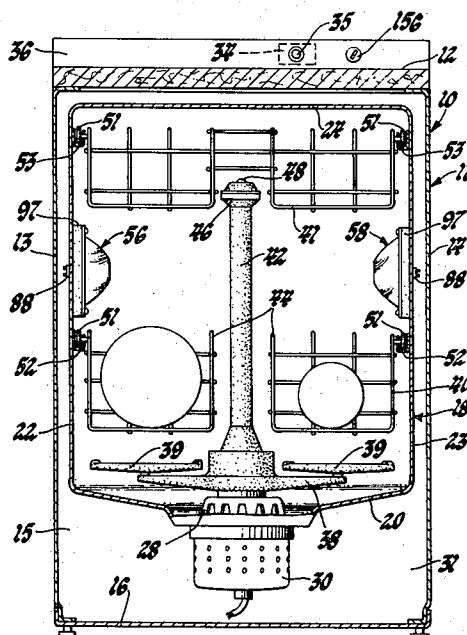
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[57]

ABSTRACT

A dishwasher having upper and lower utensil support racks in a washing chamber and a plurality of high energy radiating lamps on the walls of the chamber intermediate the racks for preselective heating of wash and rinse solutions in the chamber and for drying and sanitizing of utensils held in the racks by means of the lamps emitting selected infrared, visible and ultraviolet energy within the chamber.

4 Claims, 9 Drawing Figures



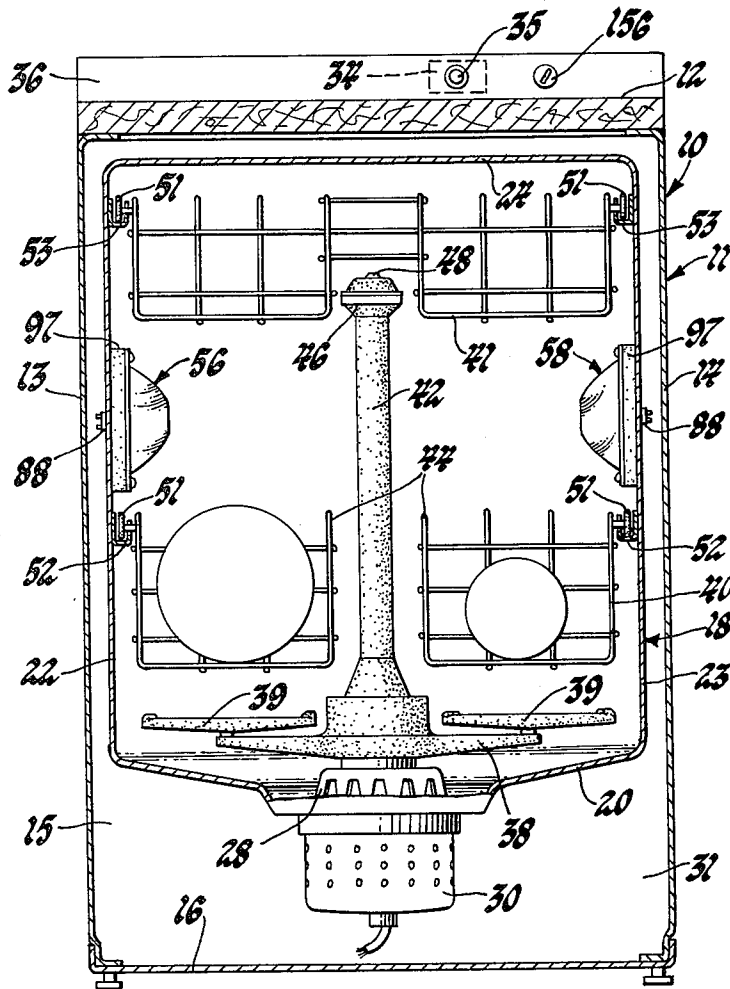


Fig. 1

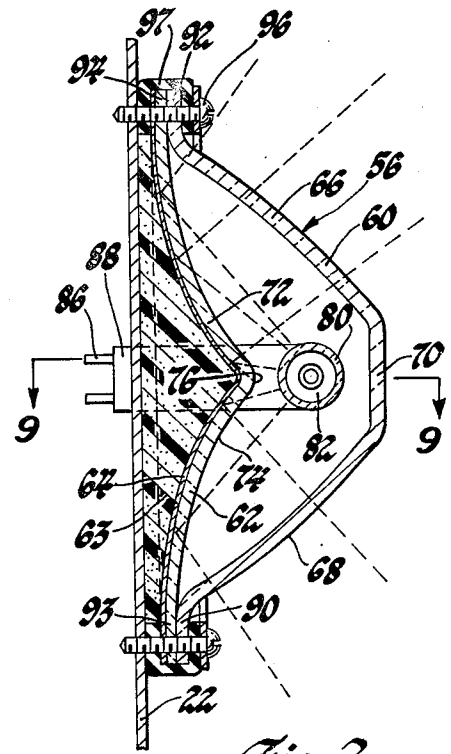


Fig. 2

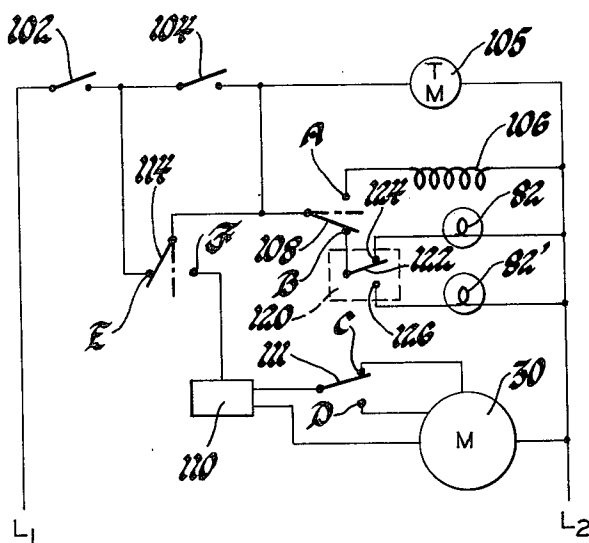


Fig. 3

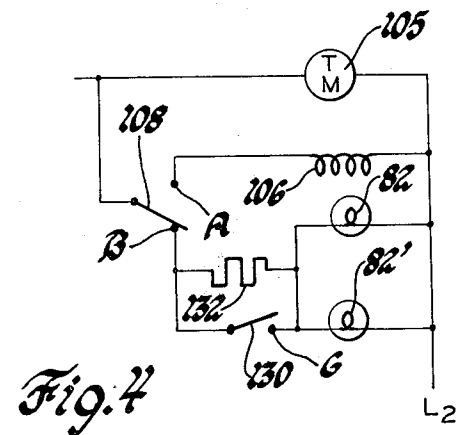


Fig. 4

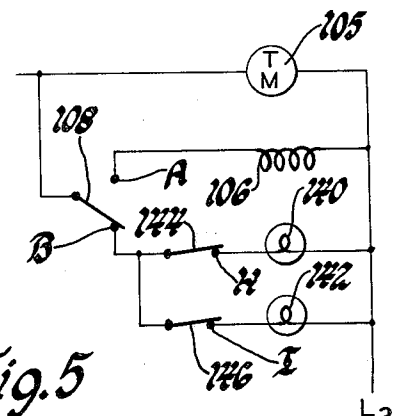


Fig. 5

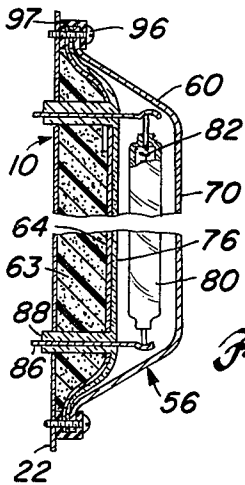


Fig. 9

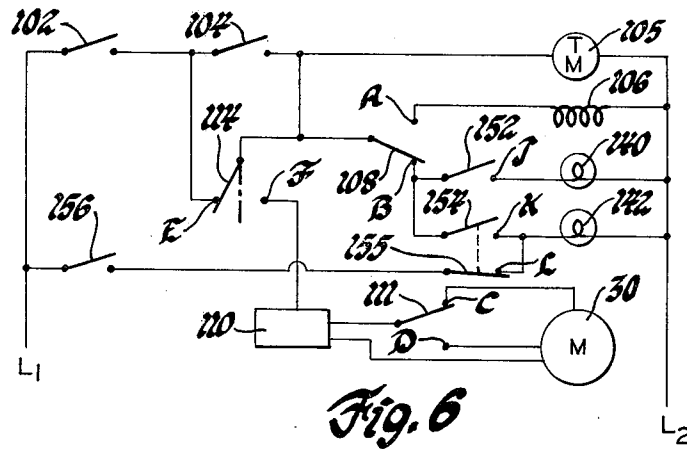


Fig. 6

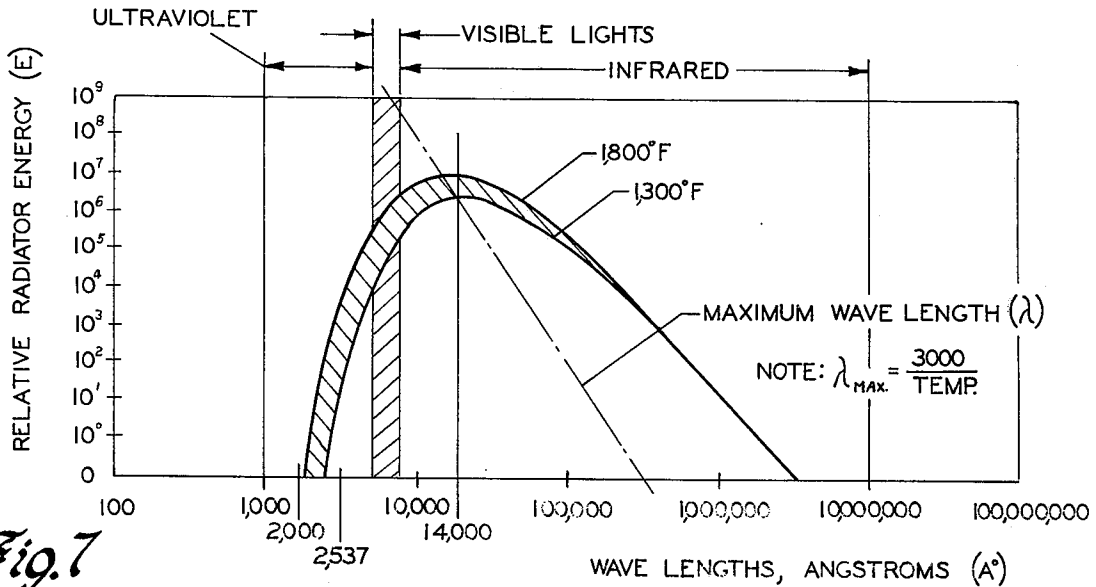


Fig. 7

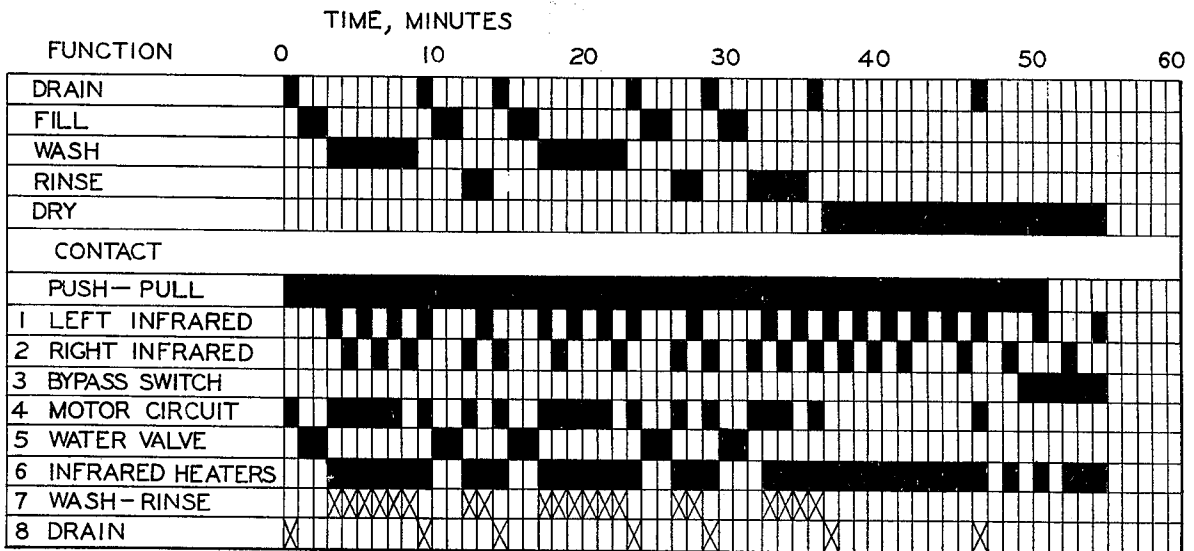


Fig. 8

☒ CONTACT CLOSED ONLY MOMENTARILY UNTIL MOTOR STARTS

DISHWASHER WITH ENERGY RADIATING HEAT LAMPS

This invention relates to dishwashers and more particularly to a dishwasher having high energy radiating reflective type heat lamps on the walls of the washing chamber to provide heating of the washing and rinsing solutions and to provide improved drying time together with germicidal purification of the utensils located in rack means within the chamber.

It is well known that water is a good absorber of electromagnetic energy in the infrared wave length ranges up to about 14,000 Angstroms (A). At shorter wave lengths, approaching visible light at 7,500 A, water becomes only a fair absorber of electromagnetic energy. In the very short infrared, visible, and near ultraviolet ranges of about 7,500 to 3,000 A, water is a poor absorber of electromagnetic energy. This condition, however, suddenly reverts in the range above 1,500 A, and water again becomes a good absorber of ultraviolet energy. Since an ordinary tungsten filament heater element in a borosilicate glass envelope is one of the lowest cost sources of infrared, visible and ultraviolet energy, the present invention contemplates such high energy lamps operating in the range of about 2,000 to 14,000 A within a dishwashing chamber to provide radiated energy directed at the utensils in the dish racks and the wash and rinse solutions within the washing chamber.

It is therefore an object of this invention to provide high energy radiating heat lamps in a dishwasher chamber in the form of tungsten filament elements incased in quartz tubes or the like which may be alternately pulsed off and on to provide a band of radiated energy in and above the infrared range which is used to heat wash and rinse solutions in the chamber and to dry the utensils located in the chamber racks by means of directional lamp reflectors.

It is another object of this invention to provide high energy radiating lamps in a household dishwasher chamber in the form of infrared heater lamps having tungsten filaments incased in borosilicate glass envelopes energized by circuit means operable to vary the voltage applied to the high energy lamps so as to change the wave lengths of the emitted bands of electromagnetic energy having wave lengths in the range of 2,000 to 14,000 A which is readily transmitted and adapted to heat the wash and rinse solutions and to dry and sanitize the utensils, both having varying absorption characteristics, which are used and placed in the dishwasher.

Further objects and advantages of the present invention will be apparent from the following description, wherein preferred embodiments of the present invention are clearly shown.

FIG. 1 is a generally schematic representation of a domestic dishwasher incorporating the invention;

FIG. 2 is an enlarged vertical cross section taken through the left hand heat lamp of FIG. 1;

FIG. 3 is a schematic wiring diagram suitable for use with the dishwasher of this invention;

FIGS. 4, 5 and 6 are alternative schematic wiring diagrams suitable for use with various modifications of the dishwasher heating system.

FIG. 7 is a graph of curves showing how the radiant energy (e) given off by heated objects is distributed over a wide range of wave lengths;

FIG. 8 is a timing and contact sequence chart for one embodiment of the invention; and

FIG. 9 is a horizontal sectional view taken substantially on line 9—9 of FIG. 2.

In accordance with this invention and with reference to FIG. 1, a dishwasher 10 is shown having an outer cabinet 11 which includes a top 12, side panels 13 and 14, a rear panel 15, a base 16 with the front panel and door not shown and adapted to include the dishwashing tub or chamber shown generally at 18. The dishwashing chamber 18 is a generally box-like receptacle having a depressed bottom defining a bottom sump 20 and including side walls 22 and 23, and a top wall 24. The dishwasher chamber walls are constructed of any good infrared reflecting material, preferably stainless steel having a highly polished inner surface.

The water distribution system of the dishwasher 10 includes a pump assembly 28 driven by a suitable drive means, for example a reversible motor 30 disposed below the pump assembly in the machinery compartment 31. The pump assembly 28 includes a rotatable horizontal spray arm 38 to which fluid is supplied from the sump region 20 for distribution through the washing chamber 18 during a cleaning cycle of the dishwasher as established by a sequency or timer control means 34 having a timer control knob 35 located on the front of the dishwasher control panel 36.

In general, the water distribution system includes the revolving spray arm unit 38 including rotating sprays 39 located beneath lower and upper utensil supporting racks 40 and 41 respectively, and a rotating spray column or tower 42 fixed to the spray arm 38 and extending upwardly through a guard portion 44 of the lower rack permitting the removal of the lower rack from the dishwashing chamber. The spray column 42 may be formed with enlarged bulbous housing or header portion 46 at the top thereof having an upper spray nozzle or outlet 48, aimed through an open passageway formed by central wire network on the upper utensil supporting rack, as shown for example in the U.S. Pat. No. 3,648,931 issued Mar. 14, 1972 and assigned to the assignee of the instant application, the disclosure of which is incorporated by reference herein and reference may be had to the above patent for details of a typical spray system.

The upper rack 41 may be used for cups, glasses, bowls, saucers, etc., while the lower rack is adapted for receiving plates, bowls, serving dishes, pots and pans and silverware and a silverware basket (not shown). The racks are made of heavy gage steel wire which is coated with suitable resilient materials such as white vinyl plastic. Each rack has nylon rollers indicated at 51 to allow easy movement of the racks 40 and 41 in and out of the dishwashing chamber during loading and unloading thereof. The nylon rollers 51 glide on stainless steel glides such as 52 for the lower rack and 53 for the upper rack, which are suitably fastened such as by welding to the side walls 22 and 23 of the washing chamber.

Positioned on each of the side walls of the washing chamber intermediate the upper 41 and lower 40 racks on the left and right hand tub walls 22 and 23 are a pair of high energy radiating lamp assemblies generally indicated at 56 and 58, the left hand lamp assembly 56 being shown in detail in FIG. 2. As the lamp assemblies are identical in the preferred embodiment only the left hand lamp will be described in detail. The lamp 56 includes a glass envelope comprising an outer elongated

glass cover 60 and an inner glass base 62. In the disclosed form the glass is formed from a borosilicate glass such as Pyrex or the like. The elongated base 62 has a reflective coating plated on the underside thereof which in the preferred form is a gold plating 64 to provide a good infrared reflection.

The glass cover 60 includes as part of its composite shape a pair of convex surface portions 66 and 68 that extend rearwardly and longitudinally so as to be separated by a central longitudinal bridging section 70 or surface portion that is connected at its outer periphery to the convex portions. The base 62 is preferably in the form of two concave faces or lobes 72 and 74 of parabolic character that are joined by a central rounded cuspidal edge or ridge portion 76 to reflect heat energy from a high energy lamp 80 preferably made of a tubular clear quartz oxygen free envelope with a tungsten filament 82 extending substantially the lamp length and at each end of the filament terminate in a metal plate. It will be noted that a nickel chromium alloy filament wire may also be used. The ends of the lamp are squeezed flat and conductors extend into suitable terminals 86 embedded in a porcelain socket 88.

The cover plate 60 of the lamp assembly 56, which is transparent to infrared radiation, is placed over the high intensity quartz lamp 80 and rests on the dual lobed reflector base 62. The cover plate 60 has longitudinal edge flanges 90 and 92 thereon which are joined to the upper and lower peripheral edges 93 and 94 of the reflector base 62 by resilient sealing ring 97 of U-shape section formed of suitable elastic material to seal the lamp assembly. The flanges 90 and 92 are secured to the outer periphery of the reflector base 62 by suitable fastening means such as threaded screws 96 for mounting the heating lamp 56 on the side wall 22 of the dishwashing chamber. To bring the lunar peripheral portions 94 and 95 and the concave faces 72 and 74 of the base reflector 62 into good thermal contact with the dishwasher wall 22, such that the wall acts as a heat sink to assist in cooling the lamp assembly 56, the space between the base reflector 62 and the tub wall 22 is filled with a suitable mastic material or elastic compound 63 to act as a conductive heat transfer path or media for the lamp base 62.

As shown in FIG. 3, power from a 115 volt power supply L_1, L_2 is provided for energizing the components of the control circuitry. In order to prevent operation of the dishwasher 10 with its access door open, a door switch 102 is included. The sequentially operated circuitry of the dishwasher 10 is controlled by the timer 34 having a push-pull knob 35 controlling line switch 104 such that the timer motor 105 is selectively energized whenever the control knob 35 is depressed or pushed inwardly. The timer motor is adapted to sequentially open and close a plurality of cam-actuated contacts. A solenoid-actuated fill valve 106 is selectively energized through a cam-actuated switch blade 108 to open and close contact A for energizing the fill valve (not shown). A current responsive motor start relay 110 serves to energize the appropriate motor start windings (not shown) in accordance with the time selection of switch blade 111 and contacts C or D for a brief period until the motor 30 comes up to its designed running speed and the current flow in the main winding drops off. Bypass switch 114 is operative through contacts E and F to return the timer push-pull knob 35 to its outward stop position after a full washing and drying cycle.

The filament 82 for the lamp 56 and the filament 82' for the lamp 58 are energized from heating filament contact B which is opened and closed by switch blade 108 actuated by a cam on the timer shaft. The push-pull switch 104 is located on one end of the axially shiftable timer shaft and is closed whenever the timer motor 105 is actuated to control a dishwashing cycle as described, for example, in U.S. Pat. No. 3,635,229 issued Jan. 18, 1972, and assigned to the same assignee as the instant application.

A pulser control, indicated at 120, has a switch blade 122 movable between contacts 124 and 126 to alternately energize the high energy lamp filaments 82 and 82' respectively, and heat the wash and rinse solutions in the dishwasher chamber during the washing cycle to insure that the water temperature is maintained above about 150° F. The pulser 120 also alternately energizes the filaments 82 and 82' during the drying cycle to provide radiated heat energy that cooperates with the adjacent concave portions 72 and 74 of the base 62 to reflect heat energy from the filaments such that it is directed at each of the racks 41 and 40 respectively, thereby achieving fast efficient drying of the utensils in the racks.

In order to dissipate sufficient heat energy in the tungsten filaments, they are operated in a temperature range of the order of 1,300° to 1,800° F. The filaments provide a radiation source which will give off radiant heat energy in the form of wave-lengths rich in infrared and moderate levels of visible light and some ultraviolet. It will be noted that energy in these wave-lengths, ranging from about 14,000 to 2,000 Å, is readily transmitted by the borosilicate glass cover 60 with the exception of an absorption band in the 10,000 Å range. It should also be stated that ultraviolet energy in the wave-length range of about 4,000 to 1,500 Å has germicidal effects, and particularly at the 2,537 Å wave-length (0.2537 micron), indicated on the wave-length versus relative radiated energy graph of FIG. 7, with the result that some radiation in the ultraviolet range of the lamp assemblies 56 and 58 will be effective in destroying bacteria. The cross section portion of the graph shows the distribution of electromagnetic energy radiated by a source operating in the temperature range of 1300° to 1800° F. It will be noted that the total energy E radiated, plotted on the vertical, is a function of the fourth power of the temperature of the source.

Thus, the radiant energy curves of FIG. 7 show the electromagnetic energy spectrum distribution of the lamp filaments 82 and 82', indicated by the cross hatched area, operating within the range of 1300° to 1800° F. It will be observed that the cross hatched area peaks in the near infrared visible and ultraviolet range of about 3,000° to 14,000° Å (0.300 to 1.400 microns).

The various materials placed into the dishwasher racks, such as water, detergents, water-shedding solutions, china, plastic, metal, represent such a broad mix of absorption characteristics and present a problem in preselecting one set of emitter lamp characteristics to best suit all of these materials. One solution to this problem is disclosed in the modified schematic circuit of FIG. 4 wherein like components are represented by the same reference characters. It will be seen that circuit means are shown to vary the voltage supplied to the filaments 82 and 82' of the high energy lamp assemblies 56 and 58 and thus to change the wave-lengths of the emitted bands of electromagnetic energy so as to better suit the broad mix of absorption characteristics

of the materials being washed. Thus, timer contact G may be opened and closed by the switch blade 130 of the timer mechanism so as to alter the voltage applied to the filaments 82 and 82' via the voltage drop across the series resistor 132.

FIG. 5 disclosed another modified circuit with means to provide two different lamp filaments 140 and 142 having different resistivities and material compositions resulting in two different energy emission bands. Timer controlled switches 144 and 146 and their contacts H and I are provided to energize lamp filaments 140 and 142, respectively. The filament 140 is designed with a higher resistance than filament 142 and consequently operates at a lower temperature to provide a rich infrared band beneficial for heating the water in the chamber during both the washing and drying cycles. The lower resistance of filament 142 is designed to operate at a higher temperature to provide a rich ultraviolet wave-length band beneficial for destroying bacteria for germicidal control.

FIG. 6 discloses a circuit for a further modification of the invention wherein timer controlled contacts J and K are provided to energize lamp filaments 140 and 142, respectively during different intervals of the dishwashing cycle. In the circuit the timer operates switch blade 152 to close on timer contact J to energize high infrared emitting filament 140 during the initial drying stages of the dishwasher while switch blade 154 is operated to close timer contact K and energize high ultraviolet emitting filament 142 in the pre-wash storage period and in the final phases of the drying cycle while both 152 and 154 are opened after the main cycle of the dishwasher has been completed. It will be noted that a timer contact L is provided having a timer switch blade 155 to provide a double pole-double throw switch arrangement with the switch blade 154 and contact K such that whenever contact K is opened contact L is closed to bypass open switch blade 154. In this manner a manual control panel ultraviolet switch 156 allows the operator the option whereby utensils being stored in the racks 40 and 41 for several hours or days may be again subjected to energy in the bacteria destroying ultraviolet range by manually energizing filament 142 by means of switch 156.

While the embodiment of the present invention constitutes a preferred form, it is to be understood that other forms might be adopted.

I claim:

1. An automatic dishwasher comprising, a casing defining a box-like washing chamber having an access opening, including top and bottom and rear walls and a pair of side walls, and having a front access door thereto closing said access opening, said walls having their inner surfaces of polished material for reflecting heat radiation therefrom, upper and lower horizontal racks secured to said dishwasher casing in the upper and lower portions of said chamber, said upper and lower racks for supporting utensils to be washed and dried, spray means for introducing wash and rinse liquid solutions into said chamber, wherein the improvement comprises high energy radiant lamp assemblies on certain of said chamber walls so as to be spaced between said upper and lower racks, each said lamp assembly having an elongated glass envelope comprising an outer glass cover and an inner glass base extending parallel to the horizontal plans of said racks, said base having concave, parabolicshaped surfaces for reflecting heat rays upwardly and downwardly to said upper

and lower racks, respectively; a high energy filament lamp disposed in longitudinal alignment to and coextensive with said surfaces of each said lamp assembly to cause portions of the heat energy from said lamps to radiate to said upper and lower racks, and control means for operating the lamps during the wash and rinse cycle of said spray means in the range of 1,300 to 1,800° F. resulting in infrared radiation being directed by said reflective chamber walls to substantially all surfaces of the utensils thereby heating the wash and rinse liquid solutions; and said control means energizing the lamps during the drying cycle for directing infrared, visible ultraviolet radiation by said reflective chamber walls to substantially all surfaces of the utensils in said racks for drying and sanitizing the utensils.

2. An automatic dishwasher comprising, a casing defining a box-like washing chamber having an access opening, including top and bottom and rear walls and a pair of side walls, and having a front access door thereto closing said access opening, said walls having their inner surfaces of polished material for reflecting heat radiation therefrom, upper and lower horizontal racks secured to said dishwasher casing in the upper and lower portions of said chamber, said upper and lower racks for supporting utensils to be washed and dried, spray means for introducing wash and rinse liquid solutions into said chamber, wherein the improvement comprises a high energy radiant lamp assembly on each of said side walls so as to be spaced between said upper and lower racks, each said lamp assembly having an elongated glass envelope comprising an outer glass cover and an inner glass base extending parallel to the horizontal planes of said racks, said base having a pair of concave, parabolicshaped surfaces defining juxtaposed lobes in vertical section along a common cuspidal edge, a metallic coating on the outer surface of said glass base for reflecting heat rays upwardly and downwardly to said upper and lower racks, respectively; a high energy tungsten filament tubular lamp disposed in longitudinal alignment to and coextensive with said cuspidal edge of each said lamp assembly to cause approximately equal portions of the heat energy from said lamp to radiate to said upper and lower racks, and control means for operating the lamps during the wash and rinse cycle of said spray means in the range of 1,300° to 1,800° F. resulting in infrared radiation being directed by said reflective chamber walls to substantially all portions of said chamber thereby heating the wash and rinse liquid solutions; and said control means energizing the lamps during the drying cycle for directing infrared, visible and ultraviolet radiation by said reflective chamber walls to substantially all surfaces of the utensils in said racks for drying and sanitizing the utensils.

3. The dishwasher as defined in claim 1 wherein said control means including a pulser operative for movement between a pair of energizing contacts for each said heat lamp, respectively whereby said pulser alternately energizes said lamp filaments during the wash and rinse cycles thereby insuring that the water temperature is maintained above about 150° F.

4. An automatic dishwasher comprising, a casing defining a box-like washing chamber having an access opening, including top and bottom and rear walls and a pair of side walls, and having a front access door thereto closing said access opening, said walls having their inner surfaces of polished material for reflecting heat radiation therefrom, upper and lower horizontal

racks secured to said dishwasher casing in the upper and lower portions of said chamber, said upper and lower racks for supporting utensils to be washed and dried, spray means for introducing wash and rinse liquid solutions into said chamber, wherein the improvement comprises a high energy radiant lamp assembly on each of said side walls so as to be spaced between said upper and lower racks, each said lamp assembly having an elongated glass envelope comprising an outer borosilicate glass cover and an inner glass base extending parallel to the horizontal planes of said racks, said base having concave, parabolic-shaped surfaces for reflecting heat rays upwardly and downwardly to said upper and lower racks, respectively; a high energy tungsten filament tubular lamp disposed in longitudinal alignment to and coextensive with said surfaces of each said lamp assembly to cause portions of the heat energy

from said lamps to radiate to said to said upper and lower racks, and timer control means of operating the lamps during the wash and rinse cycle of said spray means in the range of 1,300° to 1,800° F., the filament of each said lamp having different resistivities, one of said lamp filaments operating at a lower temperature within said range to provide a rich infrared wave-length band being directed by said reflective chamber walls for heating the water in the chamber during both the washing and rinsing cycles, said other lamp filament operating at a higher temperature within said range to provide a rich ultraviolet wave-length band being directed by said reflective chamber walls to substantially all surfaces of the utensils for drying and sanitizing the utensils.

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