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(54) **Operating cycle for industrial dishwasher**

(57) An operating cycle for an industrial dishwasher, in addition to the conventional wash (W) and rinse (R) phases, includes a heating phase (H) carried out during the wash (W) by loading into the tank a certain amount of water at 85°C coming from the heater, a phase of res-

toration of the initial conditions in the heater prior to the rinse phase (R), and a waiting phase (S) prior to the cycle end signal and to the unlocking of the door so as to achieve the sanification of the dishes by reaching the 3600 HUE (Heat Unit Equivalent) threshold required by the US standard NSF/ANSI 3-2007.

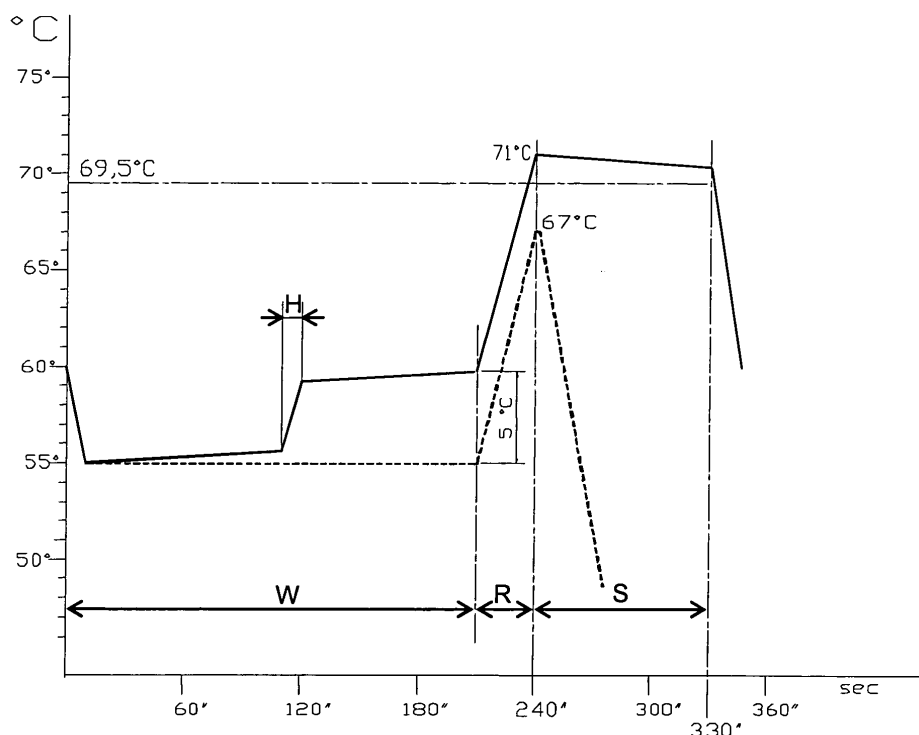


Fig.2

Description

[0001] The present invention relates to industrial dishwashers, and in particular to an operating cycle aimed at achieving a sanitification effect on the dishes.

[0002] It is known that industrial dishwashers used in professional fields (restaurants, bars, etc.) are capable of washing dishes within extremely reduced times, thanks to some constructional features that make them different from domestic dishwashers in various respects. In particular, thanks to the presence of two distinct wash and rinse circuits each having its own sprinklers, the wash water is sprayed onto the dishes by a wash pump and during the rinse a portion of this water is replaced by rinse water pre-heated in a heater and fed to the rinse circuit by a suitable rinse pump or through the pressure of a hot water network controlled by an electrovalve.

[0003] Moreover, the rinse water is pre-heated in the heater to 80-85°C, the dishes are arranged at a significant mutual distance to allow an optimal wash from both above and below, the wash sprinklers have a high flow rate and pressure and there is provided a single wash rack. All these features make industrial dishwashers very effective at washing dishes and the like, but they are not intended to guarantee that the dishes reach and maintain a certain temperature, given that performing a fast cycle has always been a priority.

[0004] It is well-known that the elimination of bacteria/viruses by heating the dishes is affected by two factors: time and temperature. The US standard NSF/ANSI 3-2007, for example, provides that 3600 HUE (Heat Unit Equivalent) are required to achieve a sanitification effect. Based on the HUE value tables calculated in this standard, said threshold corresponds for example to maintaining for 430" a temperature of 66°C, while 67" are sufficient at a temperature of 70°C.

[0005] However the length of a complete cycle of an industrial dishwasher usually does not exceed 240", said cycle starting with a wash phase with recirculation of the water already in the tank at a temperature close to 60°C, the temperature then immediately dropping to about 55°C due to the introduction of the cold dishes. The resistor located in the tank to heat the water is usually not switched on during the wash, whereby there is no addition of heat but rather dissipation and the temperature tends to decrease.

[0006] On the other hand, even if the resistor was switched on during the wash this would imply a temperature increase of about 0,4°C/minute and since the wash phase lasts about 180-210" it would result in an increase of just 1,2-1,4°C at the end of said phase.

[0007] During the rinse phase, that is carried out using the water pre-heated to about 85°C in the heater, even in the best conditions the dishes temperature will reach about 67°C at most; whereafter the "cycle end" signal is given and the dishwasher door can be opened, with a subsequent sudden decrease in temperature.

[0008] It is therefore clear that a conventional operating

cycle of an industrial dishwasher is unsuitable to reach the 3600 HUE threshold required by the NSF/ANSI 3-2007 standard to achieve a sanitification effect.

[0009] Simply increasing the wash temperature is not a satisfactory solution because it involves various drawbacks. For example, performing the wash at 68°C, a temperature at which the 3600 HUE threshold is reached in about 170", implies a significant power consumption in order to keep hot the water in the tank and it is also too high a temperature that could cause glasses to break and/or make difficult to remove the food residues by "cooking" them on the dishes.

[0010] Even increasing the rinse temperature is not effective, since the rinse phase lasts only 30" and in the conventional cycle the water is already at about 85°C and can not be heated to temperatures beyond 90°C in order to prevent the generation of steam in the heater and a significant heat dissipation due to the rate of evaporation of water that dramatically increases beyond 90°C.

[0011] Finally, it is clear that it is unacceptable to reach the sanitification threshold by exponentially extending the duration of the operating cycle, since the shortness of the cycle is a fundamental feature for industrial dishwashers. Furthermore, this would imply a great increase in consumption since it is obvious that the longer is the time of permanence at high temperature the greater is the heat dissipation.

[0012] Therefore the object of the present invention is to provide an operating cycle for an industrial dishwasher which overcomes said drawbacks. This object is achieved by means of a cycle including one or more additions of hot water coming from the heater during the wash phase, as well as a final waiting phase after the rinse prior to giving the "cycle end" signal and allowing to open the dishwasher door.

[0013] The main advantage of the operating cycle according to the present invention is that of reaching the required sanitification threshold without resorting to too high wash or rinse temperatures, and without excessively extending the cycle length.

[0014] A further advantage of this cycle stems from the fact that its implementation does not require any additional component with respect to those conventionally already present in dishwashers.

[0015] These and other advantages and characteristics of the cycle according to the present invention will be clear to those skilled in the art from the following detailed description of an embodiment thereof, with reference to the annexed drawings wherein:

Fig.1 is a diagram of the dishwasher components cooperating in the implementation of the cycle according to the invention; and

Fig.2 is a time/temperature chart of said cycle compared to a conventional cycle.

[0016] With reference to figure 1, there is seen that an industrial dishwasher conventionally includes a dish rack

1, in which dishes are washed by upper and lower wash sprinklers 2 and 3, respectively, fed by a wash pump 4. At the end of the wash phase, the rinse is carried out by switching on the rinse pump 5 that draws water at about 85°C from heater 6 and feeds it to the upper and lower rinse sprinklers 7 and 8, respectively. An amount of water equal to that introduced in the tank by the rinse pump 5 is drained by a drain pump 9 before, during or after the rinse.

[0017] The simple and effective cycle according to the present invention is described in the chart illustrated in Fig. 2, where a conventional cycle (in broken line) is compared to the above-mentioned cycle (in solid line).

[0018] As shown in said chart, the conventional cycle includes only one wash phase W lasting 210", performed substantially at the constant temperature of 55°C reached at the beginning of the cycle due to the cooling caused by the cold dishes, followed by a rinse phase R lasting 30" that takes the temperature to a maximum of 67°C.

[0019] The novel aspect of the present cycle resides in the addition of at least one short heating phase H that overlaps the wash phase W, and of a final sanification phase S that follows the rinse phase R.

[0020] More specifically, the heating phase H is carried out by switching on for a short time, indicatively 5-20" most preferably 10", the rinse pump 5 so as to load into the tank a certain amount of water at 85°C coming from heater 6, indicatively about 2 liters, after a certain time from the cycle start and preferably about halfway through the wash phase W. In this way, in the time remaining to the end of the wash phase W there is no problem in refilling heater 6 with the amount of water used in the heating phase H and restoring the water temperature in heater 6 to the conventional 85°C for the rinse phase R.

[0021] Since the temperature in the tank at the end of the wash phase W is increased by about 5°C, this allows to reach a dishes temperature of over 71°C at the end of the rinse phase R. The sanification phase S according to the above-mentioned standard is carried out by imposing a delay of 80-100", preferably 90", in giving the "cycle end" signal. In fact, even taking into account the downward tolerances in detecting the temperatures in the tank and in heater 6, there is the guarantee that the dishes temperature is never below 69,5°C at which temperature about 85 seconds are sufficient to reach the 3600 HUE threshold (and there is also a contribution of the rinse phase R to reaching said threshold).

[0022] It should be noted that, in the illustrated example, during the wash phase W there is provided the operation of the heating resistor present in the tank, but said resistor could even remain switched off for the whole or a part of the duration of the wash depending on the temperature and amount of the water introduced during the heating phase H. Moreover, the latter could be carried out even earlier or a little later than halfway through the wash, as long as the time remaining before rinse is sufficient to restore the initial conditions in heater 6.

[0023] Another possibility is that of dividing the heating phase H into a plurality of short-length loading phases, for example five "pulses" lasting 2 seconds each. This is particularly advantageous when the introduction of water from heater 6 to the tank is performed by means of the network pressure rather than by a rinse pump 5 as illustrated above.

[0024] In fact, in this way the colder water entering heater 6, typically at 50-60°C from a hot water network, does not have the time to mix with the water at 85°C already present in heater 6 whereby there is no difference in the addition of heat to the tank with respect to the use of the rinse pump 5. Furthermore the division into pulses allows to quickly restore the water temperature in heater 6 after each pulse, since the amount of colder water introduced into heater 6 is minimal. Therefore it is also possible to distribute the heating phase H in a more homogeneous manner along the wash phase W, since it is sufficient that the last pulse occurs in time for restoring the temperature in heater 6 prior to the rinse phase R.

[0025] Similarly, the duration of the sanification phase S may be decreased by increasing the temperature at the end of the rinse phase R, which can be achieved through the increase in one or more of the following parameters: temperature at the beginning of the wash phase W, temperature increase during the heating phase H and temperature increase during the rinse phase R.

Claims

1. Operating cycle for an industrial dishwasher having a door that closes a wash tank provided with a heating resistor and suitable to receive a rack (1) in which the dishes are washed by upper and lower wash sprinklers (2, 3) fed by a wash pump (4), and then rinsed by upper and lower rinse sprinklers (7, 8) fed with hot water coming from a heater (6), said cycle including the steps of:

- a) switching on the wash pump (4);
- b) operating the wash pump (4) for a preset period of time;
- c) switching off the wash pump (4);
- d) switching on the feed to the rinse sprinklers (7, 8);
- e) feeding the rinse sprinklers (7, 8) for a preset period of time;
- f) switching off the feed to the rinse sprinklers (7, 8);
- g) giving a "cycle end" signal and unlocking the dishwasher door; and being **characterized in that** it includes the further steps of:
 - b') loading into the tank hot water coming from the heater (6) during step b);
 - b'') restoring the initial conditions in the heater (6) prior to step d);
 - f) sanifying the dishes through a waiting phase

between steps f) and g).

2. Operating cycle according to claim 1, **characterized in that** step b') is carried out in a single load about halfway through step b). 5
3. Operating cycle according to claim 1, **characterized in that** step b') is divided into a plurality of load pulses distributed along step b). 10
4. Operating cycle according to one of the preceding claims, **characterized in that** step b') lasts between 5" and 20", preferably 10".
5. Operating cycle according to one of the preceding claims, **characterized in that** at the beginning of step d) the temperature in the tank is about 60°C. 15
6. Operating cycle according to one of the preceding claims, **characterized in that** at the beginning of step f) the temperature in the tank is about 71°C. 20
7. Operating cycle according to one of the preceding claims, **characterized in that** step f) lasts between 80" and 100", preferably 90". 25
8. Operating cycle according to one of the preceding claims, **characterized in that** step b') is carried out by switching on a rinse pump (5). 30
9. Operating cycle according to one of claims 1 to 7, **characterized in that** step b') is carried out by operating an electrovalve that controls the introduction into the heater (6) of water at 50-60°C coming from a hot water network. 35
10. Operating cycle according to one of the preceding claims, **characterized in that** during step b) the heating resistor present in the tank is switched on. 40

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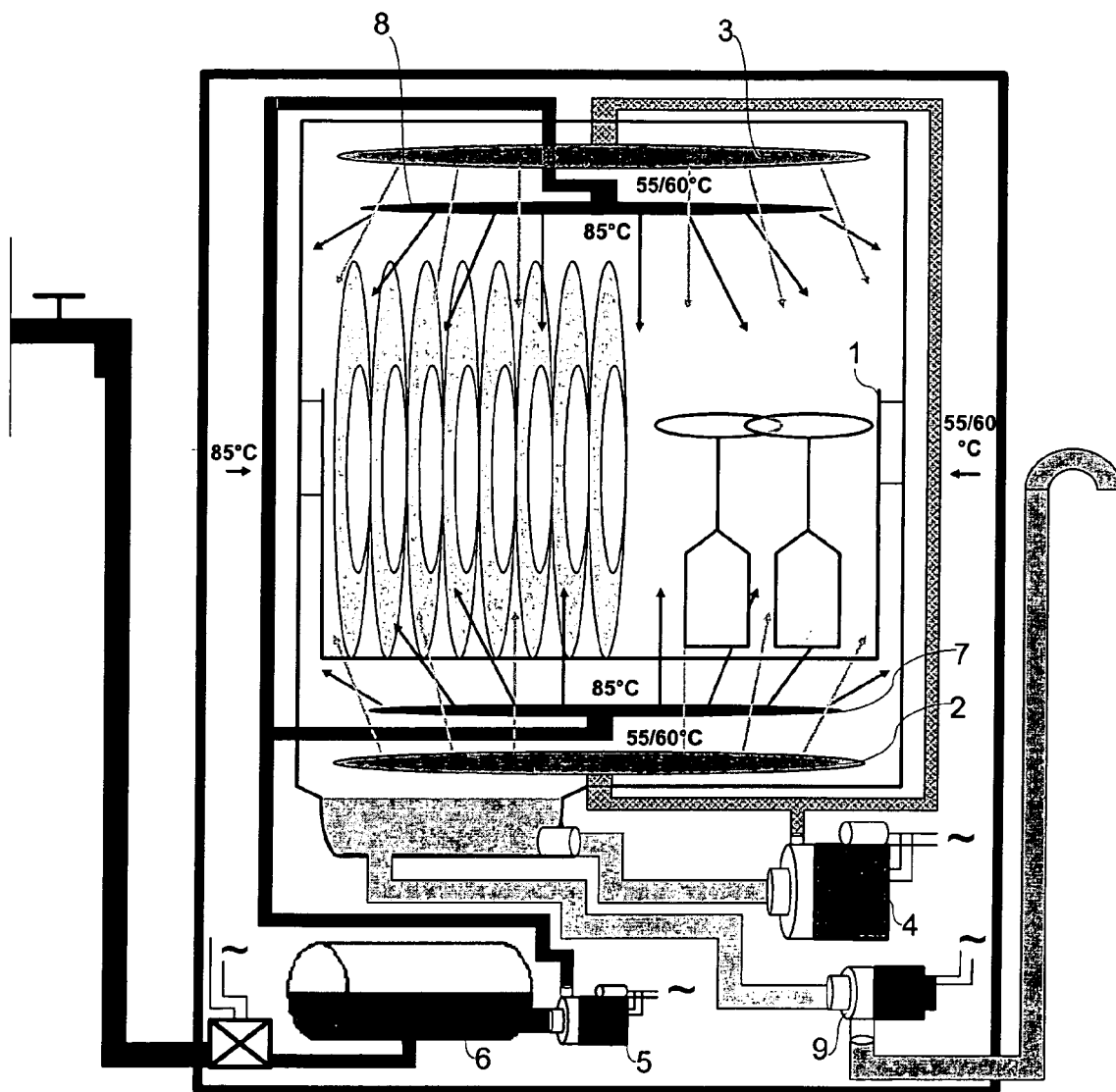


Fig.1

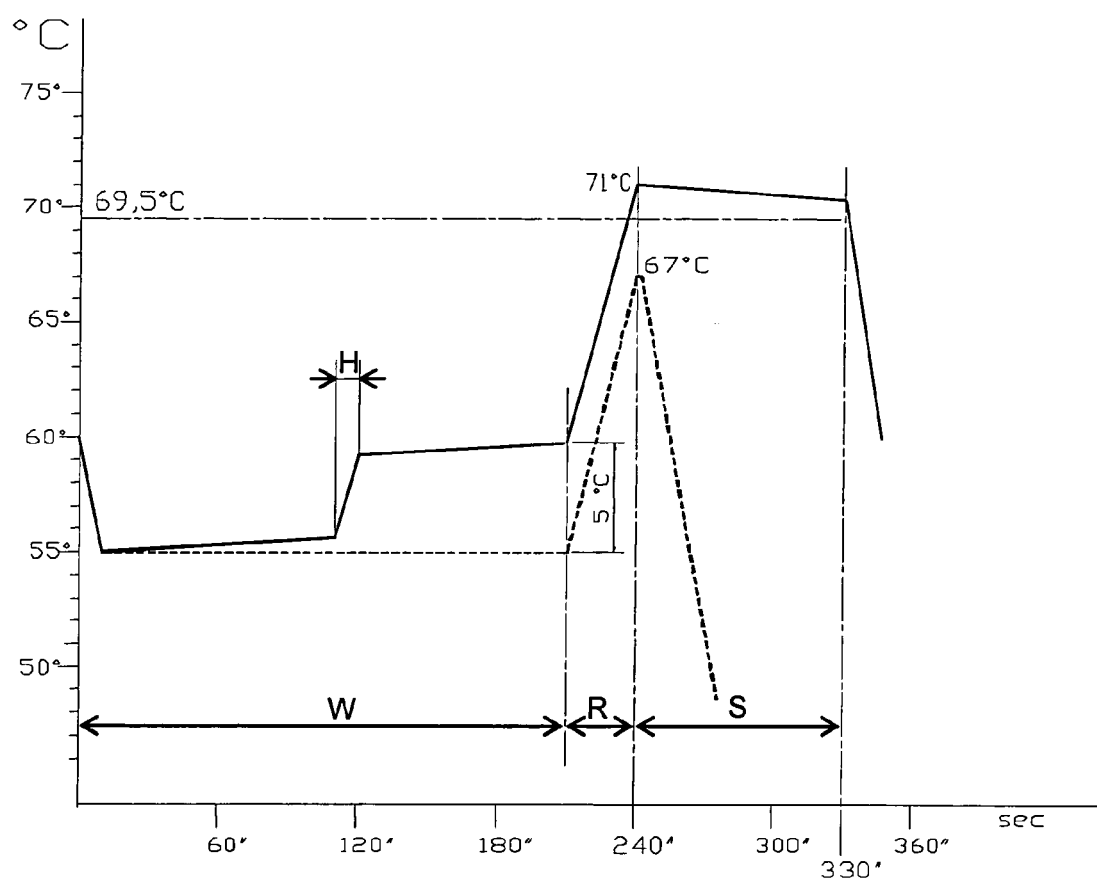


Fig.2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5601

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 21 February 2008	Examiner Hubrich, Klaus
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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