(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 905 339 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.04.2008 Bulletin 2008/14

(51) Int Cl.:
A47L 15/42 *(2006.01)*

(21) Application number: **06425662.1**

(22) Date of filing: **27.09.2006**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

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(54) **Industrial dishwasher with improved water softening circuit**

(57) An industrial dishwasher includes a softener (2) with decalcifying resins through which the water coming from the network reaches a break tank (3), connected to the wash tank (9) of the dishwasher, and through said break tank (3) reaches a heater (4) that feeds rinse sprinklers (8) that spray it in the wash tank (9) where it is then collected in a sump (13), the break tank (3) being provided with an expansion chamber (Y), interposed between the inlet of the water coming from the softener (2) and the outlet toward the heater (4), provided with an outlet that connects it directly to the sump (13) through a pipe (B) that bypasses the heater (4), the flow through the bypass pipe (B) being controlled by a valve (12). In this way, it is possible to carry out the regeneration of the decalcifying resins of the softener (2) simultaneously with a wash cycle, without having to resort to pause periods or to complicated double water treatment circuits, whereby the regeneration is carried out only when required and without significantly affecting the exploitation of the machine.

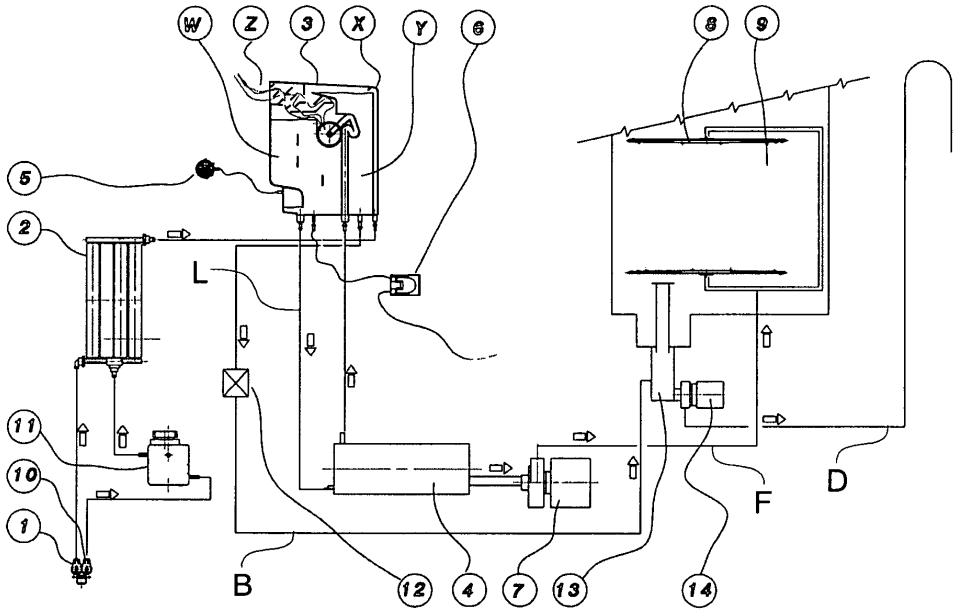

Fig.1

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Description

[0001] The present invention relates to industrial dishwashers, and in particular to a dishwasher with an improved water softening circuit.

[0002] It is known that industrial dishwashers used in professional fields (restaurants, bars, etc.) are generally characterized by very simple load and wash circuits both because they have to be as reliable as possible, since they are working tools, and because there are no internationally recognized standards that require to meet particular performance restraints.

[0003] Said circuits are different from those of domestic dishwashers in various respects, in particular in the presence of two distinct wash and rinse circuits each having its own sprinklers. In other words, 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.

[0004] More specifically, when said machines are provided with an integrated water softening circuit, the water coming from the network passes through the softener and reaches a break tank, connected to the wash tank, from where it is fed to the heater, the level inside the latter being controlled through a pressure switch connected to an air trap in communication with the heater through a suitable duct. A brightener dosing pump is also connected to said duct, and a heater vent is in turn connected to said break tank.

[0005] An aspect in common with domestic dishwashers is the water softening process carried out by means of decalcifying resins that remove from the water the calcium and magnesium salts contained therein. These resins have to be periodically regenerated by means of a sodium chloride solution and the regeneration step requires a minimum time of at least 7 minutes, so that the sodium chloride solution is combined by ion exchange with the calcium and magnesium salts present on the resins thus removing them.

[0006] However, this is only the time required for the chemical reaction in the softener whereas the overall time needed to carry out the regeneration is about 15-20 minutes; this is because you have to consider also the subsequent emptying of the tank and the complete replacing of the water inside the heater after having washed away the sodium chloride solution from the resins, to prevent salt water from reaching the tank.

[0007] In fact, during the resin regeneration and wash step, even assuming that the heater is maintained full, once the break tank is full the sodium chloride solution overflows to the tank and is clear that due to the high salt concentration a lot of water is needed to wash away the sodium chloride solution from the tank. Moreover, also the rinse pump must be operated to completely remove the sodium chloride solution from the break tank, using more water to wash the heater that at this point is also polluted by the sodium chloride solution. Since the regeneration step is followed by a new tank and heater filling step, the overall stop of the machine can be even longer than 30 minutes, with a significant waste of water and power.

[0008] Considering that the duration of a wash cycle is in the range of 2-4 minutes, routine operations like this that imply a machine stop longer than 5-10 minutes are unacceptable if a suitable exploitation of the machine is to be achieved. As a consequence, these operations are carried out during the periods of pause in the use of the machine but said periods very seldom coincide, according to the number of performed wash cycles and therefore of the liters of softened water, with the time of the actual need for regeneration of the resins.

[0009] This results in the machine being forced to operate with already completely "spent" resins possibly for several cycles or vice versa it may be forced to regenerate resins still capable of treating plenty of water. In the first instance it is clear that the water is not softened and therefore the expected wash results are not achieved, and in the second instance a waste of water and salt occurs.

[0010] To overcome this drawback there are also models of industrial dishwashers that in order to prevent pauses in the operation are provided with double water treatment circuits that are completely identical and capable of operating alternatively, but this involves an evident manufacturing complexity and significantly affects the costs.

[0011] Therefore the object of the present invention is to provide an industrial dishwasher which overcomes said drawbacks. This object is achieved by means of an industrial dishwasher in which the break tank is provided with an expansion chamber interposed between the inlet of the water coming from the softener and the outlet to the heater, said expansion chamber being provided with an outlet that connects it directly to the tank sump through a pipe that bypasses the heater, the flow through said bypass pipe being controlled by a suitable valve. Other advantageous features of the present industrial dishwasher are disclosed in the dependent claims.

[0012] The main advantage of the dishwasher according to the present invention is that it can carry out the regeneration of the resins simultaneously with a wash cycle, without having to resort to pause periods or to complicated double water treatment circuits, whereby the regeneration is carried out only when required and without significantly affecting the exploitation of the machine. This results also in lower water and salt consumptions and better wash results, as well as lower manufacturing cost with respect to a dishwasher with double circuits.

[0013] A further advantage of this dishwasher stems from the integration into said break tank, in its preferred embodiment, of the pressure switch air trap and of the brightener inlet, so as to dispense with the relevant duct mounted on the heater that is therefore cheaper to manufacture.

[0014] These and other advantages and characteris-

tics of the industrial dishwasher 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 diagrammatic view showing only the softening and rinse circuits; and
Fig.2 is an enlarged view of the break tank illustrated in fig.1.

[0015] With reference to said figures, there is seen that an industrial dishwasher according to the present invention conventionally includes a first network water inlet valve 1 that controls the flow to a softener 2, containing decalcifying resins, through which the water reaches a break tank 3. From break tank 3, through a pipe L, the water is fed to a heater 4 whose filling level is controlled by a pressure switch 5, while a brightener pump 6 provides the dispensing of the brightener when required.

[0016] During the rinse step, a rinse pump 7 takes the heated water from heater 4 and sends it , through a feed pipe F, to the rinse sprinklers 8 that spray it into tank 9. The water is then collected in sump 13 at the bottom of tank 9, and from there discharged through a drain pipe D by means of a drain pump 14.

[0017] For the regeneration of the resins of softener 2 there is provided a second network water inlet valve 10 that controls the flow to a salt container 11, to prepare the sodium chloride solution that reaches then softener 2 where it combines with the resins to clean them from the calcium and magnesium salts.

[0018] The particular structure of break tank 3 according to the present invention is better illustrated in detail in fig.2. The break tank 3, as mentioned above, is conventionally provided with a first inlet E1, leading to an air break X, for the water coming from softener 2 and with a first outlet U1, formed at the bottom of an accumulation chamber W, to feed water to heater 4. The latter is also connected to break tank 3 through a vent pipe connected to a second inlet E2 that through a siphon S leads to an opening R connecting break tank 3 with tank 9.

[0019] A first novel aspect of the present break tank 3 is the presence of an expansion chamber Y arranged between the air break X and the accumulation chamber W, and provided at the bottom with a second outlet U2. In other words, the water entering through the first inlet E1 reaches the air break X and first fills the expansion chamber Y; once the latter is full, the water overflows to chamber W and through outlet U1 reaches heater 4. The entrance of the water to heater 4 is allowed by the fact that the air is vented to tank 9 through siphon S, connected to heater 4 through the second inlet E2.

[0020] Once heater 4 is full, water builds up in chamber W compressing the air in the air trap T until the pressure switch 5 is switched. The water loading proceeds then for a preset time such as to determine the almost complete filling of the accumulation chamber W, and the possible excess water overflows to tank 9 through connection R. During the heating of the water in heater 4, the vapor created therein rises along the pipe connected to inlet E2 and reaches siphon S form where it is discharged to tank 9, always through connection R.

[0021] In the preferred embodiment illustrated in the figures, a second novel aspect of break tank 3 resides in the air trap T, used by pressure switch 5, being integrated in the structure of the break tank at the bottom of the accumulation chamber W. Furthermore, at the bottom of the latter there is also formed a third inlet E3 to which the brightener pump 6 is connected.

[0022] A further novel aspect of break tank 3 is that at its top, in the passage region between the expansion chamber Y and the accumulation chamber W, there is formed a vapor release path Z extending from opening R upto an opening to the outside. In this way, tank 9 is provided with a vent that is useful in the heating steps when the air contained therein is dilated and allows to release vapor in a controlled manner, rather than by means of leaks through the door seal as in prior art dishwashers. To this purpose, along the path there are arranged several fins intended to favor the condensation of vapor and to limit the speed of the outflowing stream.

[0023] It should also be noted that the accumulation chamber W is advantageously made of greater size to obtain a reserve of pre-heated water to be fed to heater 4, since break tank 3 is in contact with the wall of tank 9 that heats up during the washing steps. Even in the case of extended pauses with the machine in operation, and therefore with heater 4 operating with a subsequent water evaporation, there is a continuous topping up of the level of heater 4 without having to let in water from the network thanks to the capacity of chamber W. Finally, it is possible to set "extended rinse" cycles with the same capacity of the heater by exploiting the water from chamber W as "additional amount", in that it is pre-heated.

[0024] Another novel aspect of the present dishwasher results from the presence of a bypass pipe B connecting outlet U2 of the expansion chamber Y to sump 13 of tank 9, bypassing heater 4. The water flow in pipe B, and therefore the outflow through outlet U2, is controlled by a shut-off valve 12.

[0025] In the light of the description above, the simple and reliable operation of the dishwasher according to the present invention is readily understood.

[0026] When the resin regeneration phase is started valve 12 is opened first, to empty the expansion chamber Y through the bypass pipe B and sump 13, and immediately thereafter valve 10 is opened so that the water flow passes through the salt container 11 and softener 2 is filled with sodium chloride solution. Once softener 2 is full, the sodium chloride solution reaches break tank 3 through the first inlet E1 and partially fills also the expansion chamber Y (valve 12 having been closed in the meantime), and valve 10 is closed.

[0027] After a suitable period of contact between the sodium chloride solution and the decalcifying resins, the "resin wash" is performed, i.e. the sodium chloride solu-

tion is washed away from the resins to prevent salt water from reaching the tank. To this purpose, both valve 12 and valve 1 are opened so that the network water washes the resins and reaches the expansion chamber Y without ever completely filling it, thanks to a proper management of the times and flow rates (e.g.: 5 seconds of opening of valve 1 and 10 seconds of opening of valve 12; cycle repeated 5 times). The sodium chloride solution is therefore conveyed to sump 13, bypassing heater 4, from where it is discharged by the drain pump 14, also activated for periods proportional to the amount of entered resin wash water.

[0028] Also the shape and size of sump 13 are important to guarantee that the sodium chloride solution is fully drained by pump 14, whose suction mouth is preferably located at the bottom of sump 13 to assure a complete discharge of the sodium chloride solution.

[0029] In fact, considering that the sodium chloride solution has a specific weight greater than water the latter tends to accumulate in the top portion of the sump, therefore in addition to activating the drain pump 14 it is possibly necessary to stop the wash pump (if it is operating) to allow the stratification of the two fluids having different density. The applicant has found, through experimental tests, that the volume of sump 13 should preferably be equal to or greater than the volume of the regeneration water, which in turn must be at least equal to the resin volume.

[0030] From the above it is easily understood how it is possible to carry out a wash cycle simultaneously with the resin regeneration. In fact, while the wash and rinse pumps take water from heater 4, and possibly from the accumulation chamber W, the resin regeneration only affects softener 2 and the expansion chamber Y. Only at the time of discharging the sodium chloride solution through sump 13 there may be a short interference with the wash cycle, but it is a period of just a few minutes after which the machine is fully operative.

[0031] It is clear that the above-described and illustrated embodiment of the dishwasher according to the invention is just an example susceptible of various modifications. In particular, the exact shape and arrangement of break tank 3, of the bypass pipe B and of the shut-off valve 12 can be freely changed according to specific manufacturing needs, as long as the above-illustrated operational capacity is retained.

Claims

1. Industrial dishwasher including a softener (2) with decalcifying resins through which the water coming from the network reaches a break tank (3), connected to the wash tank (9) of the dishwasher, and through said break tank (3) reaches a heater (4) that feeds rinse sprinklers (8) that spray it in said wash tank (9) where it is then collected in a sump (13) located at the bottom of the tank (9), **characterized in that** the break tank (3) is provided with an expansion chamber (Y) interposed between the inlet (E1) of the water coming from the softener (2) and the outlet (U1) toward said heater (4), said expansion chamber (Y) being provided with an outlet (U2) that connects it directly to said sump (13) of the tank (9) through a pipe (B) that bypasses the heater (4), the flow through said bypass pipe (B) being controlled by a valve (12).

2. Industrial dishwasher according to claim 1, **characterized in that** the break tank (3) also includes an air trap (T) to which there is connected a pressure switch (5) that controls the filling level of the heater (4).

3. Industrial dishwasher according to claim 1 or 2, **characterized in that** the break tank (3) also includes a further inlet (E3) to which there is connected a brightener pump (6).

4. Industrial dishwasher according to one of the preceding claims, **characterized in that** the break tank (3) also includes a vapor release path (Z) extending from an opening (R) that communicates with the wash tank (9) upto an opening to the outside.

5. Industrial dishwasher according to the preceding claim, **characterized in that** the vapor release path (Z) is provided with a plurality of fins suitable to favor the condensation of vapor and to limit the speed of the outflowing stream.

6. Industrial dishwasher according to one of the preceding claims, **characterized in that** the break tank (3) includes an accumulation chamber (W) sized so as to act as a reserve of water sufficient to feed the heater (4) in case of an extended pause of the machine with the heater (4) in operation, or in case of "extended rinse" cycle, without requiring the admission of further network water.

7. Industrial dishwasher according to one of the preceding claims, **characterized in that** the volume of the sump (13) is equal to or greater than the volume of the decalcifying resins contained in the softener (2).

8. Industrial dishwasher according to one of the preceding claims, **characterized in that** it includes a drain pump (14) whose suction mouth is located at the bottom of the sump (13).

9. Method for the regeneration of the decalcifying resins of the softener (2) of an industrial dishwasher according to one of the preceding claims, **characterized in that** it includes the following steps:

a) opening the valve (12) that controls the flow in the bypass pipe (B) to empty the expansion chamber (Y);
b) opening the valve (10) that controls the inlet of network water to a salt container (11) to obtain a sodium chloride solution to be fed to the softener (2);
c) closing the valve (12) of the bypass pipe (B);
d) closing the inlet valve (10) of the network water after the sodium chloride solution has completely filled the softener (2) and partially filled the expansion chamber (Y);
e) waiting for a suitable period of contact between the sodium chloride solution and the decalcifying resins;
f) opening the valve (12) of the bypass pipe (B) and the valve (1) that controls the inlet of network water to the softener (2) to wash away the sodium chloride solution from the resins;
g) closing the valves (1, 12) mentioned at the previous step and then opening them again, performing a plurality of opening/closing cycles with such durations that the expansion chamber (Y) is never completely filled;
h) discharging the sodium chloride solution and the resin wash water from the sump (13) by means of the drain pump (14).

10. Method according to the preceding claim, **characterized in that** one or more of steps a)-g) are carried out during the wash cycle and step h) is preceded by the stop of the wash pump and/or of the rinse pump.

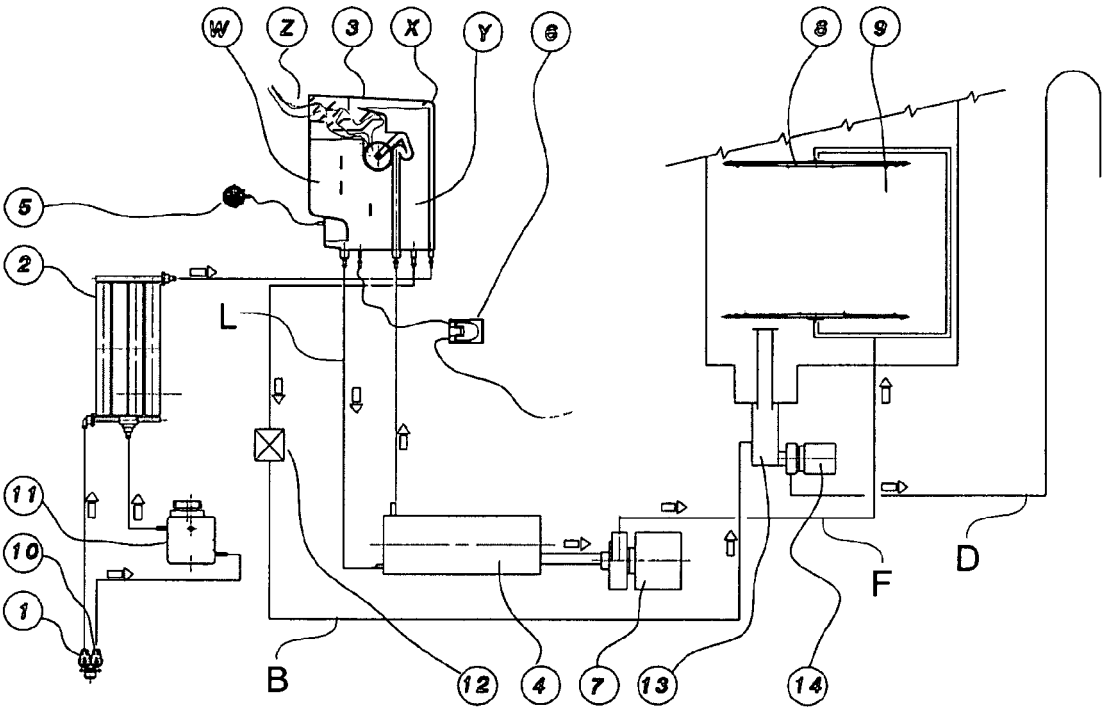

Fig.1

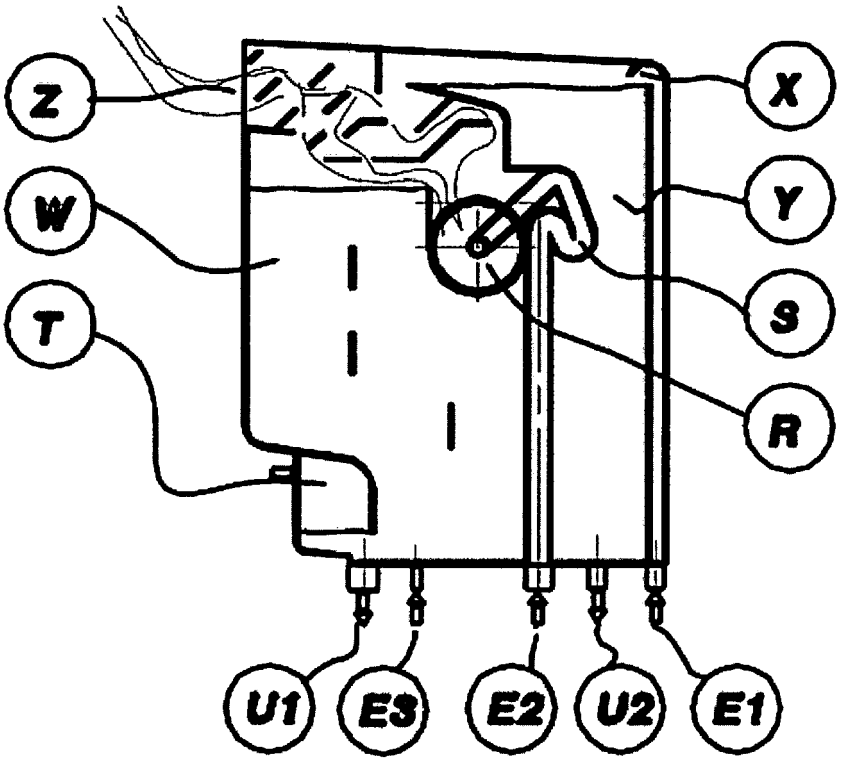

Fig.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 42 5662

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 0 547 011 A (COLGED S R L [IT]) 16 June 1993 (1993-06-16) * column 1, line 32 - column 3, line 13; figure 1 *	1,9	INV. A47L15/42
A	EP 1 462 050 A (DIHR SPA [IT]) 29 September 2004 (2004-09-29) * paragraphs [0001], [0018] - [0021]; figures *	1,9	
A	EP 0 768 059 A (CANDY SPA [IT]) 16 April 1997 (1997-04-16) * column 3, line 34 - column 4, line 25; figure 2 *	4,5	

TECHNICAL FIELDS SEARCHED (IPC)

A47L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	13 February 2008	Lopez Vega, Javier

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 42 5662

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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13-02-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0547011 A	16-06-1993	DE 69217629 D1	03-04-1997
		DE 69217629 T2	02-10-1997
		ES 2100330 T3	16-06-1997
		IT 1252886 B	04-07-1995
EP 1462050 A	29-09-2004	NONE	
EP 0768059 A	16-04-1997	IT MI951700 A1	03-02-1997

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82