



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
07.08.2013 Bulletin 2013/32

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

(21) Application number: **12425021.8**

(22) Date of filing: **02.02.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(72) Inventor: **Gobbi, Ezio**
46037 Roncoferraro (MN) (IT)

(74) Representative: **Concone, Emanuele et al**
Società Italiana Brevetti S.p.A.
Via Carducci 8
20123 Milano (IT)

(71) Applicant: **Bonferraro S.p.A.**
37060 Bonferraro (VR) (IT)

(54) **Industrial dishwasher with improved water softening circuit and relevant operating method**

(57) An industrial dishwasher includes a softener (2) with decalcifying resins through which water coming from the network (1) through a first inlet valve (EV1) reaches a break tank (3) and from there a heater (4) that feeds rinse sprinklers (6) by means of a rinse pump (5), a second network water inlet valve (EV2) that controls the flow towards a salt container (13) to obtain a sodium chloride solution which then reaches the softener (2), a deviating valve (14) located between the softener (2) and the break tank (3) and suitable to direct the water flow towards the break tank (3) through a first outlet (A) or directly towards a drain pipe (11) through a second outlet (B) and a first

bypass pipe (BP1) that bypasses the break tank (3), as well as a third network water inlet valve (EV3) that controls the flow from the network (1) directly to the break tank (3) through a second bypass pipe (BP2) that bypasses the softener (2). In this way, it is possible to divide the hydraulic circuit of the dishwasher into a water softening circuit and a wash circuit that are completely independent and therefore to carry out the regeneration of the resins simultaneously with one or more wash cycles, 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.

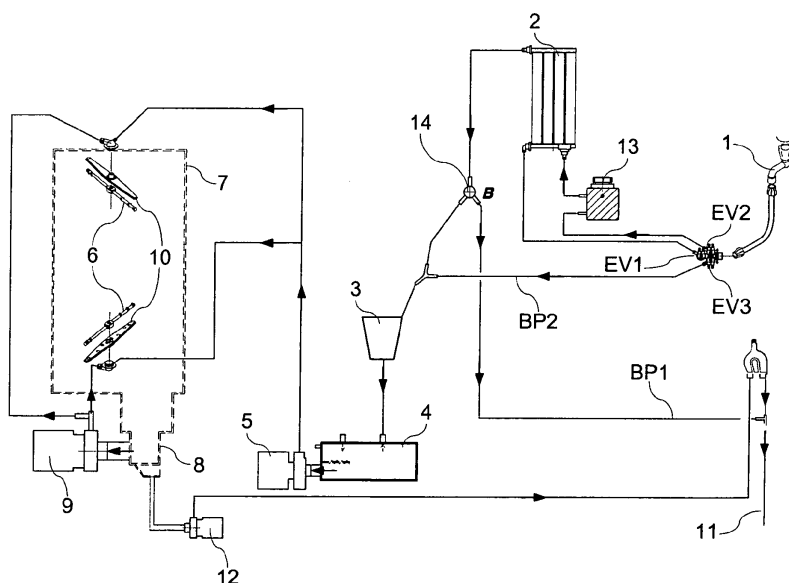


Fig.2

Description

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

[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. 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.

[0003] 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. 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.

[0004] 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 resin regeneration step requires a minimum time of at least 6-7 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.

[0005] 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.

[0006] 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.

[0007] Considering that the duration of a wash cycle

of an industrial dishwasher 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.

[0008] 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 therefore the expected wash results are not achieved and the calcium and magnesium salts may damage the machine, while in the second instance a waste of water and salt occurs.

[0009] 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.

[0010] The applicant has already disclosed in EP 1905339 an arrangement to overcome the above-mentioned drawback at least in part 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.

[0011] In this way, it is possible to 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.

[0012] However, even this dishwasher still has some drawbacks both in manufacturing and use. In the first place, the presence of the expansion chamber in the break tank, as well as that of an accumulation chamber preferably of increased size, makes it bulkier and more expensive. Moreover, it is possible to carry out one or more wash cycles during the resin regeneration step only with some limitations.

[0013] In fact, when the resin regeneration phase is started the valve of the bypass pipe is opened first to empty the expansion chamber through the bypass pipe and the sump, and immediately thereafter the valve allowing the water in the salt container is opened so that

the softener is filled with sodium chloride solution until the latter overflows into the break tank and partially fills also the expansion chamber (the bypass valve having been closed in the meantime). After that when the sodium chloride solution is washed away from the resins, to prevent salt water from reaching the tank both the bypass valve and the network water inlet valve are opened so that the network water washes the resins and reaches the expansion chamber without ever completely filling it, thanks to a proper management of the opening times of the valves and of the flow rates.

[0014] The sodium chloride solution is therefore conveyed to the sump, bypassing the heater, from where it is discharged by the drain pump which is also activated for periods proportional to the amount of entered resin wash water. It should be noted that in this arrangement also the shape and size of the sump are important to guarantee that the sodium chloride solution is fully drained by the drain pump. In fact, the suction mouth of the drain pump is located at the bottom of the sump to assure a complete discharge of the sodium chloride solution that due to a specific weight greater than water tends to accumulate in the bottom portion of the sump.

[0015] Therefore in addition to activating the drain pump it is possibly necessary to stop the wash pump (if it is operating) to allow the stratification of the two fluids having different density. Furthermore, in order to achieve a proper operation of the machine it is necessary that the volume of the sump is equal to or greater than the volume of the regeneration water, which in turn must be at least equal to the resin volume.

[0016] It is readily understood from the above that while it is possible to carry out a wash cycle simultaneously with the resin regeneration step, at the time of draining the sodium chloride solution and the resin wash water through the sump there is an interference with the wash cycle. Moreover, since during the regeneration the wash and rinse pumps can only use the water present in the heater and possibly in the accumulation chamber of the break tank, the possibility of a continuous operation of the machine is limited by the capacity of said members.

[0017] In fact, due to the shortness of the wash cycle, it is possible that through an intensive use of the machine during the resin regeneration step there is reached a water consumption greater than the combined capacity of the heater and of the accumulation chamber of the break tank.

[0018] 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 provided with a deviating valve that allows to connect the softener directly to the drain, through a pipe bypassing the break tank, and provided with a secondary inlet valve connected directly to the break tank through a pipe bypassing the softener. Other advantageous features of the present industrial dishwasher are disclosed in the dependent claims.

[0019] The main advantage of the dishwasher accord-

ing to the present invention is that it can carry out the regeneration of the resins simultaneously with a wash cycle, retaining all the advantages of the above-described prior art arrangement yet without any interference with the wash cycle and without any limitation in the number of wash cycles carried out during the regeneration of the resins. Moreover, this overlapping of the wash and regeneration operations is easier to implement as to the management of the opening times of the valves and of the operating times of the pumps.

[0020] A further advantage of this dishwasher stems from the fact that it uses a standard break tank without expansion chamber and enlarged accumulation chamber, which is therefore smaller and cheaper to manufacture.

[0021] Still another advantage of the present dishwasher resides in the total independence of the sump volume from the resin volume whereby said constructional features can be optimized each according to its own needs. For example, the sump might be smaller to reduce the amount of water required for a wash cycle while the softener might be larger to increase the number of wash cycles that can be carried out between two regeneration steps.

[0022] These and other advantages and characteristics 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 the hydraulic circuit of the dishwasher with the circulation of water during the normal operation;

Fig.2 is a view similar to the preceding one showing the circulation of water during the loading of the sodium chloride solution into the softener; and

Fig.3 is a view similar to the preceding one showing the circulation of water during the washing away of the sodium chloride solution from the softener.

[0023] 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 EV1 that controls the flow from a tap 1 to a softener 2, containing decalcifying resins, through which the water reaches a break tank 3 first and from there a heater 4. During the rinse step, a rinse pump 5 takes the heated water from heater 4 and sends it to the rinse sprinklers 6 that spray it into tank 7. The water is then collected in sump 8 at the bottom of tank 7 and used also in the subsequent wash steps by means of a wash pump 9 that feeds relevant wash sprinklers 10, while a portion thereof is discharged through a drain pipe 11 by means of a drain pump 12.

[0024] For the regeneration of the resins of softener 2 there is provided a second network water inlet valve EV2 that controls the flow from tap 1 to a salt container 13 (Fig.2), to obtain the sodium chloride solution that reach-

es then softener 2 where it combines with the resins to clean them from the calcium and magnesium salts.

[0025] A first novel aspect of the present dishwasher is the presence of a deviating valve 14 located between softener 2 and break tank 3, said valve 14 being able to direct the water flow coming from softener 2 towards break tank 3, through a first outlet A (Fig. 1), or directly towards the drain pipe 11 through a second outlet B (Figs. 2-3) and a first bypass pipe BP1 that bypasses break tank 3.

[0026] A second novel aspect of this dishwasher is the presence of a third network water inlet valve EV3 that controls the flow from tap 1 directly to break tank 3 through a second bypass pipe BP2 that bypasses softener 2 (Figs.2-3). As a result, the hydraulic circuit of the dishwasher can be divided into a water softening circuit and a wash circuit that are completely independent during the resin regeneration step.

[0027] In the light of the description above, the simple and effective operation of the industrial dishwasher according to the present invention is readily understood.

[0028] When the resin regeneration phase is started (Fig.2) the hydraulic circuit of the dishwasher is divided as mentioned above by closing valve EV1 and opening valve EV2, so that the water flow passes through the salt container 13 and softener 2 is filled with sodium chloride solution, and valve EV3 so that the unsoftened network water reaches break tank 3, through bypass pipe BP2, and then heater 4. At the same time, valve 14 is switched from outlet A to outlet B so as to connect softener 2 directly with drain 11 through bypass pipe BP1, whereby the possible sodium chloride solution in excess overflowing from softener 2 does not reach break tank 3.

[0029] 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 solution is washed away from the resins to prevent salt water from reaching the tank. To this purpose (Fig.3), the first inlet valve EV1 is re-opened, the second inlet valve EV2 having been closed upon loading the sodium chloride solution in softener 2, whereby the network water washes the resins in softener 2 and the sodium chloride solution (together with the resin wash water) is directly drained through pipe BP1 bypassing break tank 3, since the deviating valve 14 is still connected to the drain pipe 11.

[0030] At the end of the operations above, which require no more than 8-10 minutes, the third inlet valve EV3 is closed and the deviating valve 14 is switched from outlet B to outlet A thus restoring the normal operating condition illustrated in Fig.1 with the two parts of the hydraulic circuit mutually connected.

[0031] From the above it is easily understood that a dishwasher according to the present invention can carry out a wash cycle simultaneously with and completely independently of the resin regeneration step. In fact, while the wash pump 9 and the rinse pump 5 take water respectively from sump 8 and heater 4, possibly integrated with network water coming directly from the second by-

pass pipe BP2, the resin regeneration only affects softener 2 and the deviating valve 14 that directs the sodium chloride solution and the resin wash water directly to drain 11 through the first bypass pipe BP1.

[0032] It should be noted that even with an intensive use of the machine during the resin regeneration (max. 4-5 wash cycles) there are no problems either for the required amount of water, since there are no capacity limitations thanks to the network supply, or for the limited use of unsoftened water. As a matter of fact, considering that heater 4 usually contains about 8 liters of softened water, that tank 7 usually contains about 22 liters of softened water and that the water consumption for each cycle is usually equal to about 3 liters, the amount of unsoftened water being used is limited to a few liters without therefore any appreciable consequence either on the machine or on the washed dishes.

[0033] 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 the bypass pipes BP1, BP2 as well as of the third valve EV3 and of the deviating valve 14 can be freely changed according to specific manufacturing needs, as long as the above-illustrated capacity of dividing the hydraulic circuit is retained.

Claims

1. Industrial dishwasher including a softener (2) with decalcifying resins through which water coming from the network (1) through a first inlet valve (EV1) reaches a break tank (3) and from there a heater (4) that feeds rinse sprinklers (6) by means of a rinse pump (5), as well as a second network water inlet valve (EV2) that controls the water flow towards a salt container (13) to obtain a sodium chloride solution which then reaches said softener (2), **characterized in that** it further includes a deviating valve (14), located between the softener (2) and said break tank (3), suitable to direct the water flow coming from the softener (2) towards the break tank (3) through a first outlet (A) or directly towards a drain pipe (11) of the dishwasher through a second outlet (B) and a first bypass pipe (BP1) that bypasses the break tank (3), as well as a third network water inlet valve (EV3) that controls the water flow from the network (1) directly to the break tank (3) through a second bypass pipe (BP2) that bypasses the softener (2).
2. Method for the regeneration of the decalcifying resins of the softener (2) of an industrial dishwasher according to the preceding claim, **characterized in that** it includes the following steps:
 - a) opening the third inlet valve (EV3) that controls the inflow of the network water directly into

the break tank (3) through the second bypass pipe (BP2);

b) closing the first inlet valve (EV1) that controls the inflow of the network water into the softener (2);

c) opening the second inlet valve (EV2) that controls the inflow of the network water into the salt container (13) to obtain a sodium chloride solution to be fed to the softener (2);

d) switching the deviating valve (14) from the first outlet (A) to the second outlet (B) so as to connect the softener (2) directly to the drain pipe (11) through the first bypass pipe (BP1);

e) closing the second inlet valve (EV2) after the sodium chloride solution has completely filled the softener (2);

f) waiting for a suitable period of contact between the sodium chloride solution and the decalcifying resins;

g) opening the first inlet valve (EV1) that controls the inflow of the network water into the softener (2) to wash away the sodium chloride solution from the resins;

h) draining the sodium chloride solution and the resin wash water through the first bypass pipe (BP1) and the drain pipe (11);

i) switching the deviating valve (14) from the second outlet (B) to the first outlet (A) so as to connect the softener (2) to the break tank (3);

j) closing the third inlet valve (EV3).

3. Method according to the preceding claim, **characterized in that** one or more of steps b)-i) are carried out during one or more wash cycles.

5

10

15

20

25

30

35

40

45

50

55

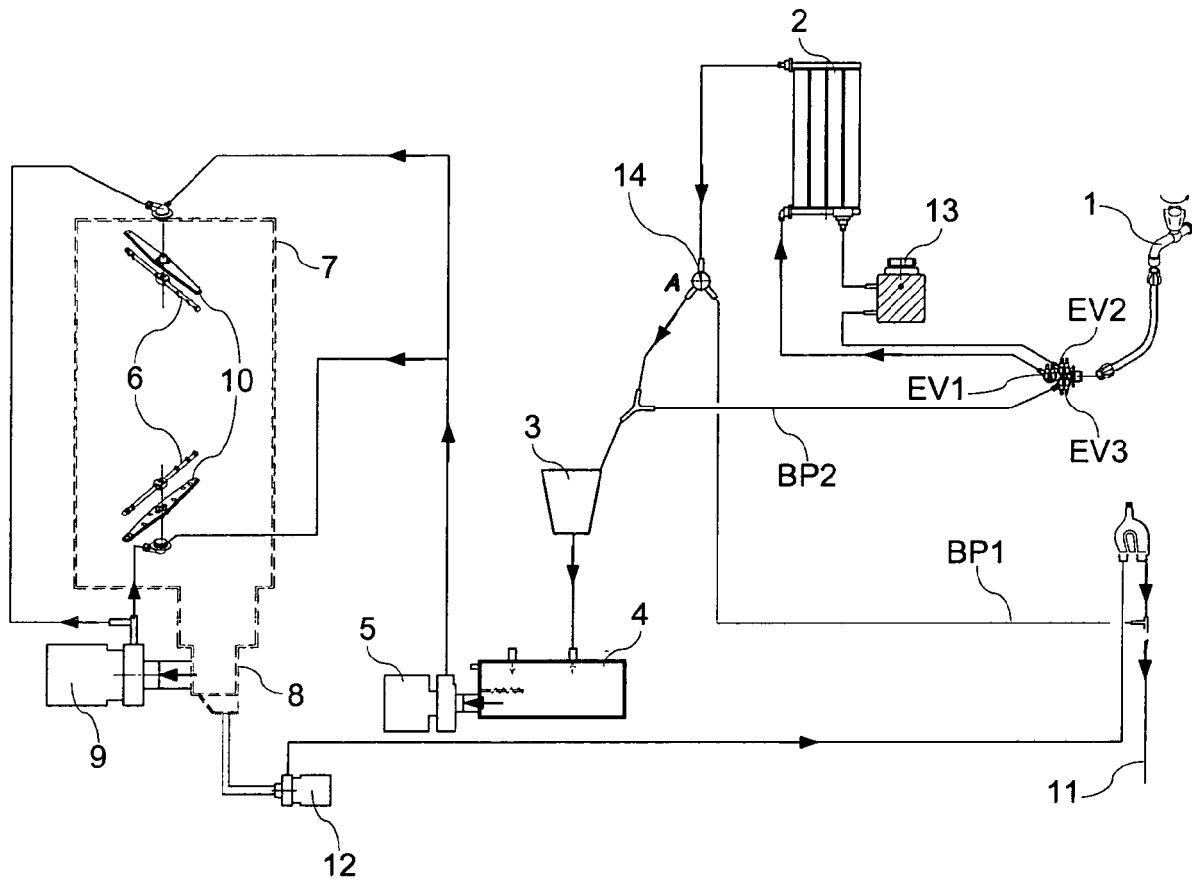


Fig.1

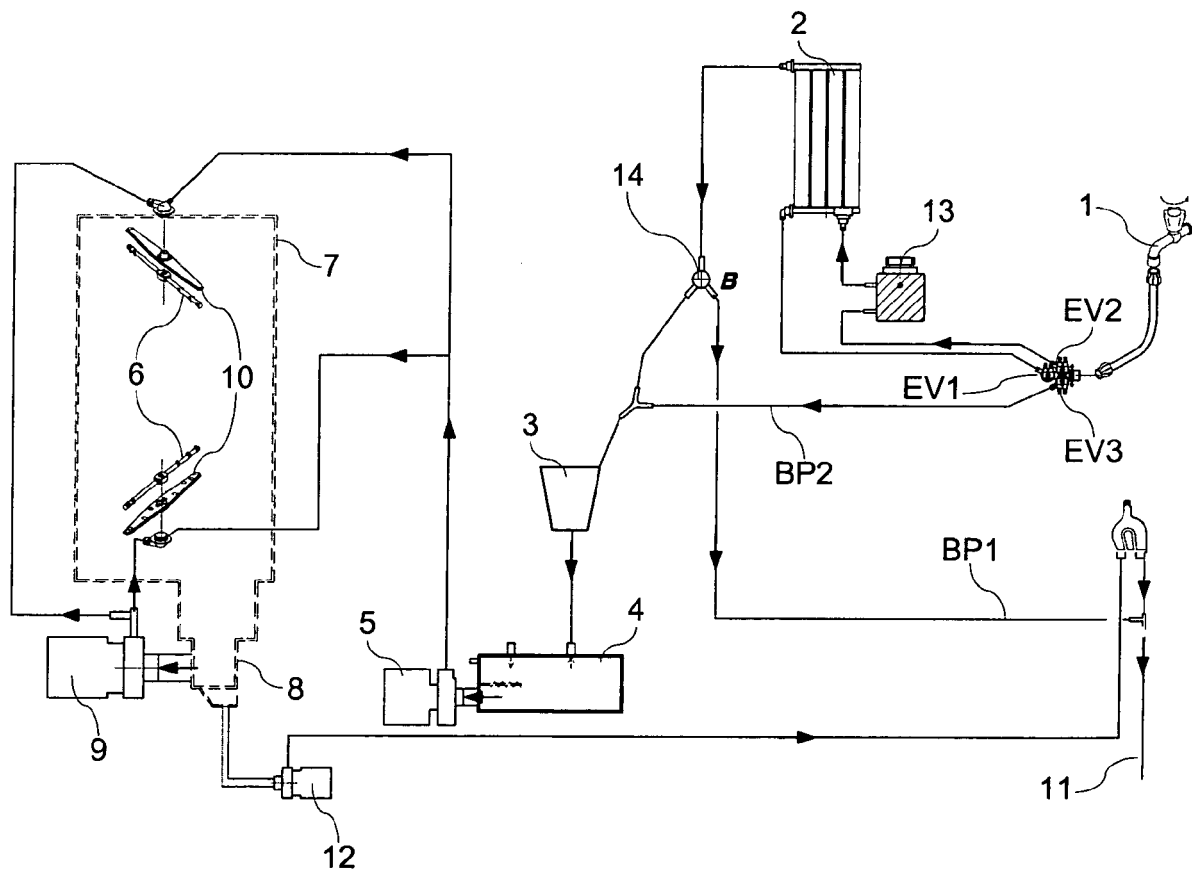


Fig.2

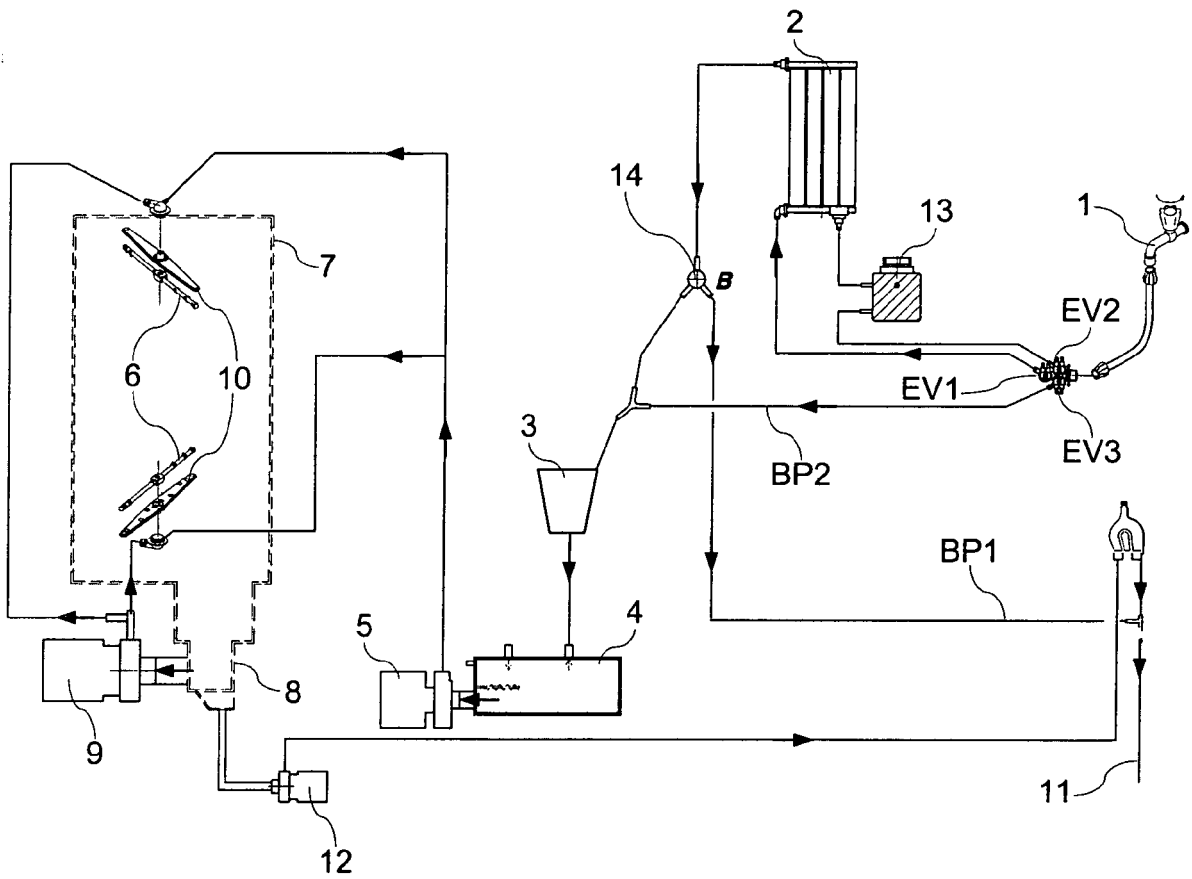


Fig.3



EUROPEAN SEARCH REPORT

Application Number
EP 12 42 5021

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,D	EP 1 905 339 A1 (BONFERRARO SPA [IT]) 2 April 2008 (2008-04-02) * the whole document *	1-3	INV. A47L15/42
A	EP 1 023 868 A2 (PREMARK FEG LLC [US]) 2 August 2000 (2000-08-02) * column 5, paragraph 24 - column 8, paragraph 37; figure 1 *	1-3	
A	EP 1 452 123 A1 (ELECTROLUX AB [SE]) 1 September 2004 (2004-09-01) * column 3, paragraph 9 - column 4, paragraph 13; figure 1 *	1-3	
A	DE 35 27 047 A1 (LICENTIA GMBH [DE]) 5 February 1987 (1987-02-05) * the whole document *	1-3	
A	DE 17 28 233 A1 (BOSCH HAUSGERAETE GMBH) 23 March 1972 (1972-03-23) * the whole document *	1-3	
			TECHNICAL FIELDS SEARCHED (IPC)
			A47L D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 24 July 2012	Examiner Lodato, Alessandra
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03/82 (P04/C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 42 5021

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

24-07-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1905339	A1	02-04-2008	AT 417540 T 15-01-2009
		EP 1905339 A1	02-04-2008
		ES 2317481 T3	16-04-2009

EP 1023868	A2	02-08-2000	DE 19903635 A1 10-08-2000
		EP 1023868 A2	02-08-2000

EP 1452123	A1	01-09-2004	AT 441352 T 15-09-2009
		EP 1452123 A1	01-09-2004

DE 3527047	A1	05-02-1987	NONE

DE 1728233	A1	23-03-1972	NONE

EPO FORM P0459

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

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1905339 A [0010]