



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) **EP 0 873 714 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.10.1998 Bulletin 1998/44

(51) Int. Cl.⁶: **A47L 15/42**

(21) Application number: 98106297.9

(22) Date of filing: 07.04.1998

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Favaro, Daniele**
30020 Pramaggiore, Venezia (IT)

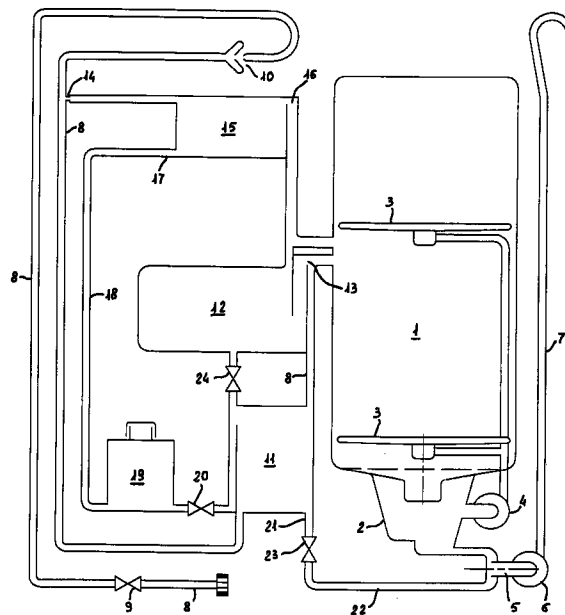
(74) Representative:
Busca, Luciano et al
PROPRIA
Protezione Proprietà Industriale srl
Via Mazzini 13
33170 Pordenone (IT)

(30) Priority: 23.04.1997 IT PN970020

(71) Applicant:
Electrolux Zanussi S.p.A.
33170 Pordenone (IT)

(54) **Automatic washing machine with regenerating system for water softening means**

(57) Dishwashing machine with a water softener (11) having an outlet (21) connected to the suction side (5) of a drain pump (6) through a timer-controlled valve (23). The pump (6) and the valve (23) are actuated simultaneously in respective phases so as to drain both the brine and the resin flushing water from the water softener while by-passing the washing tank (1) of the machine.



EP 0 873 714 A2

Description

The present invention refers to an automatic washing machine, in particular a dishwashing machine, of the type controlled by a programme control unit and provided with means for softening the water being supplied to the machine, as well as a regenerating arrangement for said water softening means.

A dishwashing machine of the above cited kind is for instance described in the Italian patent application no. TO92 A 000235 filed on March 18th, 1992, and mainly comprises a washing tank, a water softener for the in-flowing water, and a regenerating arrangement for the same water softener.

The regenerating arrangement, which in turn comprises a salt reservoir, is provided with an auxiliary chamber adapted to collect the exhausted brine and, possibly, the water user to wash the water softener after regeneration. In particular, said auxiliary chamber can be emptied through an appropriate conduit that is connected to a drain pump while by-passing the washing tank of the machine. Such a solution enables salt water to be prevented from ending up or even dwelling on the bottom of the washing tank which, since generally made of metal, might otherwise undergo corrosion problems.

On the other hand, the presence of such an auxiliary chamber undesirably complicates the construction and the structure of the whole water softener regenerating arrangement and increases the space requirements thereof, while the space generally available in dishwashing machines to accommodate the various component parts thereof is largely known to be substantially at a premium.

It therefore is a main purpose of the present invention to provide an automatic washing machine with a regenerating arrangement for water softening means which is not only capable of operating in a satisfactory manner and minimizing the possibility for the washing tank to undergo corrosion problems, but is also particularly simple in its construction and structure.

It is a further purpose of the present invention to provide a washing machine of the above cited kind, in which the whole water softening and regenerating arrangement is particularly compact.

According to the present invention, these aims are reached in an automatic washing machine provided with a regenerating arrangement for water softening means that embodies the characteristics and the features as recited in the appended claims.

Anyway, the features and advantages of the invention will be more readily understood from the description that is given below by way of non-limiting example with reference to the accompanying drawing, in which the only Figure is a schematical view of the main component parts of the water-carrying circuit of the washing machine according to the present invention, in a preferred embodiment thereof.

In the example described below, the washing

machine is a dishwasher, but it might of course be a clothes washer as well.

The dishwashing machine comprises mainly a washing tank 1 provided with a water collecting sump 2 and housing water spray means 3 which are fed by a circulation pump 4. The automatic operation of the dishwashing machine is controlled by a programme sequence control unit of a per se known type and not shown here.

The water collecting sump 2 is connected to the suction side 5 of a drain pump 6, whose delivery side is associated to a drain conduit 7.

In a preferred, but not exclusive manner, the pumps 4 and 6 are made as described in EP-B-0 268 835.

The dishwashing machine comprises a water inlet circuit which mainly comprises a conduit 8 in which there are installed in series at least a normally closed valve 9 controlled by the programme sequence control unit, a so-called "air-break" safety provision 10, and water softening means 11 (for instance, a water softener of the type containing ion-exchange resins and arranged at an appropriate level). Downstream of said water softener 11, the conduit 8 also communicates with a reservoir 12 provided to collect resin flushing water, ie. the water used to wash the water softener after regeneration. The water inlet circuit then continues in correspondence of an outlet 13 of the reservoir 12 to communicate with the washing tank 1 through a corresponding port.

Downstream of the air-break 10, a calibrated opening 14 of the conduit 8 communicates with a vessel 15 provided to collect regeneration water in a metered manner. The vessel 15 is situated at an appropriate level and is provided with an overflow device 16 communicating with the washing tank 1, as well as an outlet 17 from which a pipe 18 departs to extend through a salt reservoir 19 which in turn communicates with the water softener 11 through a normally closed valve 20 controlled by the programme sequence control unit of the machine.

The water softener 11 is provided with an outlet 21 which is connected via a drain conduit 22 to the suction side 5 of the drain pump 6, thereby by-passing the washing tank 1. The drain conduit 22 is provided with at least a normally closed valve arrangement 23 controlled by the programme sequence control unit of the machine.

In particular, the valve 23 is connected on one side (ie. downstream) to the suction side 5 of the drain pump 6 and, on the other side (ie. upstream), it is connected in a substantially direct manner to the outlet 21 of the water softener 11, said valve 23 being preferably adjacent to said outlet 21.

In a preferred manner, the water softener 11 is situated below the reservoir 12, to the bottom of which it is connected also through a water connection fitting comprising for instance a normally closed valve 24 controlled by the programme sequence control unit of the

machine. As an alternative thereto, said water connection fitting may be provided to comprise a normally open conduit with a calibrated cross-section (not shown here for reasons of greater simplicity).

In practical operation, each time that an amount of water must be filled into the washing tank 1, the programme sequence control unit of the machine causes the valve 9 to temporarily open. As a result, water from the mains starts to flow along the water inlet conduit 8, passes through the air-break 10, is softened while flowing through the water softener 11, fills the water collection reservoir 12 and finally enters the washing tank 1. At the same time, a reduced amount of water flows out of the conduit 8 through the calibrated opening 14 thereof, so as to substantially fill, in a metered and possibly adjustable manner, the collecting vessel 15 (and the pipe 18).

The general operation of the dishwashing machine can be of a substantially traditional type, comprising for instance a cycle for washing the tableware (not shown), with the related operation of the circulation pump 4, wherein said washing cycle may be preceded by a pre-wash or soak cycle and followed by one or more rinsing phases.

A regeneration phase for the ion-exchange resins contained in the water softener 11 may be for instance carried out at the beginning of a rinsing phase (to be preferably carried out on the washed tableware with hot water, in a substantially per se known manner), by letting brine into the same water softener in the manner that will be described in greater detail below.

According to the present invention, before the brine is let into the water softener 11, the programme sequence control unit of the machine causes the valve 23 to temporarily open (for instance, for approx. 30 seconds) so as to enable the water softener to at least partially let out by gravity, through the drain conduit 22, the water that had been let into the same water softener during a previous water filling phase. It should be noticed that the water that is let out of the water softener in this phase is substantially clean, softened water, so that it is not going to give rise to any corrosion problem by entering the washing tank 1 of the machine.

As an alternative thereto, during this phase in which the water softener 11 is at least partially emptied, the programme sequence control unit of the machines causes also the drain pump 6 to be temporarily switched on, so that said pump is able to directly send the water that it takes in from the water softener to the drain 7.

The above mentioned regeneration phase can at this point be started and carried out by opening the valve 20, so that the metered quantity of water stored in the collecting vessel 15 can flow by gravity along the pipe 18, pass through the salt reservoir 19 and the same valve 20, and finally substantially fill up (in the form of brine) the previously emptied water softener 11. In a per se known manner, the brime remains in the

water softener 11 for a time that is adequate to ensure an effective regeneration of the ion-exchange resins contained therein.

It should be noticed that the valve 23 is closed throughout said resin regeneration phase, so that no possibility actually exists for the brine to undesirably enter the washing tank 1.

According to another feature of the present invention, at the end of the resin regeneration phase the programme sequence control unit of the machine causes the drain pump 6 to be temporarily switched on and the valve 23 to be correspondingly opened, so as to enable the brine previously filled into the water softener 11 to be exhausted directly towards the drain 7 through the conduit 22, said water softener 11 being in this way emptied again in an at least partial manner.

Preferably, such a brine draining phase is provided at the end of one of said tableware rinsing phases, so that the pump 6 is enabled to carry out the twofold task of conveying to the drain 7 both the brine taken in from the water softener 11 and the rinsing water taken in from the sump 2 of the machine.

The programme sequence control unit of the machine then causes the valve 24 to open (preferably temporarily), so that the metered amount of softened water stored in the collecting reservoir 12 is enabled to flow by gravity into the water softener 11, thereby performing a so-called "washing" action by flushing the ion-exchange resins.

In this connection it should be noticed that the valve 23 is kept closed even during the entire resin flushing phase, so that no possibility actually exists for brine or salt water to undesirably enter the washing tank 1.

According to a further feature of the present invention, at the end of said resin flushing phase the programme sequence control unit of the machine causes the drain pump 6 to be temporarily switched on and the valve 23 to be correspondingly opened, so as to enable the resin flushing salt water previously filled into the water softener 11 to be exhausted directly towards the drain 7 through the conduit 22.

It should be noticed that even this resin flushing water draining phase may be provided at the end of one of said tableware rinsing phases, so that the pump 6 is enabled to carry out the twofold task of conveying to the drain 7 both the brine taken in from the water softener 11 and the rinsing water taken in from the sump 2 of the machine.

It will be appreciated that the above described washing machine may undergo a number of modifications without departing from the scope of the present invention.

For instance, the moments at which the various above-described operational component parts of the machine are actuated and/or the times during which they are allowed to operate may be varied according to actual needs or requirements.

In all cases, however, it will be appreciated that the

washing machine according to the present invention is provided with a water-carrying circuit and arrangement that is advantageously simple and reliable, since just a few simple and low-cost component parts are actually needed for a timer-controlled operation thereof.

Furthermore, the washing machine according to the present invention is substantially free from corrosion problems that can otherwise be brought about in the washing tank by the presence there of salt water from the regeneration and/or flushing process of the ion-exchange resins in the water softener 11.

Of particular importance appears to be also the fact that all this is obtained without any need arising for any additional chamber to be provided, since the water softener 11 is capable of containing, upstream of said timer-controlled valve 23, both the brine and the resin flushing water which are required for performing the respective operational phases. As a result, the whole water supply and softening system, including the regenerating arrangement for the water softener 11, can in a most advantageous manner be given an extremely compact and rational structure.

Furthermore, since the volumes of regeneration and resin flushing water are substantially contained upstream of the timer-controlled valve 23, even the overall amount of water used by the machine will be advantageously reduced.

Claims

1. Automatic washing machine controlled by a programme sequence control unit and comprising a regeneration arrangement for water softening means provided in the machine for softening the water being let into a washing tank thereof through a water supply circuit leading through said water softening means, said regeneration arrangement being adapted to let an amount of brine into said water softening means, so as to regenerate the ion-exchange resins contained therein, after a water supply phase in which water has been let into said washing tank, wherein said water softening means are provided with an outlet that is connected via a conduit to the suction side of a drain pump, said suction side of said pump being also connected to the bottom of the washing tank, **characterized in that** said conduit (22) comprises at least a normally closed valve arrangement (23) controlled by the programme sequence control unit of the machine and connected on one side to said suction side (5) of the drain pump (6) and, on the other side, in a substantially direct manner to said outlet (21) of said water softening means (11), said drain pump (6) being adapted to be temporarily energized, under a corresponding opening of the valve arrangement (23), so as to let out to the drain the brine previously filled in the water softening means.
2. Washing machine according to claim 1, **characterized in that** before the brine is let into said water softening means (11), said valve arrangement (23) is adapted to be temporarily opened so as to enable said water softening means (11) to at least partially exhaust by gravity, through said conduit (22), the water that had been let into the same water softening means (11) during a previous water supply phase.
3. Washing machine according to claim 1, **characterized in that** before the brine is let into the water softening means (11), said drain pump (6) is adapted to be temporarily energized, under a corresponding opening of said valve arrangement (23), so as to at least partially empty the water softening means (11) by removing from said water softening means the water that had been let into them during a previous water supply phase.
4. Washing machine according to claim 1, in which upon said brine having so been drained off said water softening means, the latter are washed through the inlet of an amount of resin flushing water, **characterized in that** said drain pump (6) is adapted to be temporarily energized, under a corresponding opening of said valve arrangement (23), so as to drain off said water softening means (11) said resin flushing water that had been previously let into them.
5. Washing machine according to claim 1, in which said machine is adapted to carry out operational cycles comprising one or more rinsing phases with water being let into the washing tank, **characterized in that** said temporary energization of the drain pump (6) and said corresponding opening of the valve arrangement (23) are provided at the end of one of said rinsing phases, so as to enable the pump (6) to perform the twofold task of sending directly to a drain (7) both the brine previously let into the water softening means (11) and the rinsing water contained in the tank (1) of the machine.
6. Washing machine according to claim 4, in which said machine is adapted to carry out operational cycles comprising one or more rinsing phases with water being let into the washing tank, **characterized in that** said temporary energization of the drain pump (6) and said corresponding opening of the valve arrangement (23) are provided at the end of one of said rinsing phases, so as to enable the pump (6) to perform the twofold task of sending directly to a drain (7) both the resin flushing water previously let into the water softening means (11) and the rinsing water contained in the tank (1) of the machine.

7. Washing machine according to claim 1, **characterized in that** said valve arrangement (23) is provided in the drain conduit (22) in a position which is close to the outlet (21) of the water softening means (11).

5

10

15

20

25

30

35

40

45

50

55

5

