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

(11) EP 1 228 735 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.08.2002 Bulletin 2002/32

(51) Int Cl.[7]: **A47L 15/42**

(21) Application number: **02002619.1**

(22) Date of filing: **05.02.2002**

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

(30) Priority: **05.02.2001 IT TO010103**

(71) Applicant: **T & P S.p.A.**
21049 Tradate (Varese) (IT)

(72) Inventors:
- **Carli, Carlo**
  21041 Albizzate (VA) (IT)
- **Ghinato, Renzo**
  21050 Bisuschio (VA) (IT)

(74) Representative: **Dini, Roberto, Dr. Ing.**
Via Castagnole, 59
10060 None (Torino) (IT)

(54) Method for detecting the lack of a regenerating agent in a washing machine, in particular a dishwasher, and system thereof

(57) Method for detecting the lack of a regenerating agent in a household washing machine, in particular a dishwasher, comprising a water softening device (1;1A) containing resins (R), which reduce their softening capacity depending on the volume of the water being treated, said softening device (1;1A) comprising a container for said regenerating agent, a sensor (3) for detecting the state of said resins, said sensor (3) containing sample resins (RC), whose volume decreases depending on their exhaustion level, where said sensor (3) comprises a movable element capable of taking at least a first operating position for the movable element to delimit a chamber containing said sample resins (RC) and where the position of said movable element is determined by a magnetic sensor (5), the method provides at least a regeneration step of the softening capacity of said resins (R;RC), during which an aqueous solution containing the regenerating agent is conveyed to the resins (R;RC), and at least a wash step of said resins (R;RC) after said regeneration. The invention is featured by the regeneration and wash steps of said resins being followed by at least a water intake in the washing machine before activating a signal to indicate the lack of said regenerating agent.

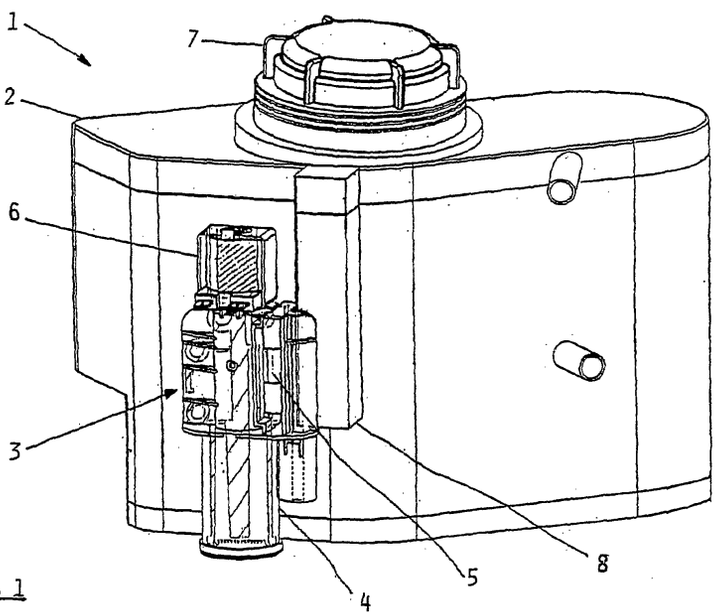


FIG. 1

EP 1 228 735 A2

Description

[0001] The present invention concerns a method for detecting the lack of a regenerating agent in a washing machine, in particular a dishwasher, and detection system thereof.

[0002] As known, dishwashing machines are equipped with a water softening device containing ion exchange resins.

[0003] After a certain number of water softening cycles, the softening capacity of the resins becomes exhausted and the resins have to be regenerated. In order to perform regeneration, they are commonly flushed with a water and salt solution, called brine in the following. As the brine is gradually utilized for regeneration, its concentration decreases, loosing its regenerating capacity for the resins. In order to avoid this situation, brine concentration has to be restored adding more salt in the special tank pertaining to the softening device.

[0004] In order to detect the lack of salt, systems have been commonly manufactured with a float containing a magnet. The float is located inside the tank containing the brine, whereas a reed is provided outside the tank in line with the magnet, i.e. a switch fitted with foils enclosed in a glass case filled with inert gas, which can be activated by a magnetic field.

[0005] The float is located in an appropriate seat operating as a guide, wherein it can slide, to hinder it from fluctuating freely inside the salt tank.

[0006] As the brine is gradually used for resins regeneration, it looses its concentration; following this concentration decrease the float inside the salt container goes downwards along its guide, because the brine concentration is no longer able to hold it in its original position.

[0007] Since the float displacement causes the magnetic field of the magnet to involve the reed and close it, a warning light will switch on. This warning light on informs the user that salt has to be added to avoid that the brine may become completely useless for resins regeneration.

[0008] It is advisable to always add salt before starting a new wash cycle, to avoid that either the salt or brine may corrode the tub if they are not washed away within a few hours.

[0009] When filling the salt tank, the float goes back to its initial position, so the reed no longer involved by the magnetic field of the magnet goes back to its open position and the warning light goes off.

[0010] Patent application TO2000A000012 filed in the applicant's name of the present patent application discloses a system for reducing water hardness of the water required for operation of an apparatus. In particular, it refers to a household washing machine as well as to a device for detecting the state of the softening resins and control methods thereof for direct control of the resins regeneration step, i.e. depending on actual restoration of the resins performance having been reached, where also the lack of salt can be detected from the resins state, without the use of any additional devices as described above.

[0011] The device for detecting the state of the softening resins mentioned above, hereafter called sensor, has a container filled with an amount of sample resins, on which a movable element is resting containing a permanent magnet. As known, as the resins gradually exhaust their efficiency level, their volume also decreases and the movable element follows the volume change of the resins accordingly; the position of the movable element is detected by means of at least one reed. According to the position reached by the movable element located on the sample resins, the reed is activated by the magnet of the movable element when affected by the magnetic field generated by it; when activated, the reed will also activate some machine functions, such as resins regeneration and their rinsing after regeneration. Moreover, it will activate a warning light indicating the lack of salt, should the sample resins not have reached a preset volume after resins regeneration and washing, due to a bad regeneration caused by the lack of salt.

[0012] This system may face several problems if no well defined application methods are available.

[0013] One problem is related to the execution time for resins regeneration during the wash cycle and their washing after regeneration; in some conditions, as known to the man skilled in the art, if both the structure and management of the wash cycle of dishwashing machines remain unchanged, this may cause a delay of one or more cycles in signalling the user about the lack of salt.

[0014] More in particular, regeneration in dishwashing machines fitted with an electromechanical programmer or electronic programmer takes place at a fixed time during the wash cycle or towards cycle end (regeneration followed by a resins wash) or during the hot wash (flushing the resins at the end of the wash, with the circulation pump still).

[0015] If the sensor reed remains closed after a regeneration step followed by a resins wash step, it is obvious that resins regeneration has not been satisfactory, because the brine did not contain enough salt. In this condition, the reed activates the salt warning light and the user will add salt in the special container. However, the warning light may have been activated not due to a lack of salt, but rather to a poor wash of the sample resins after their regeneration. After regeneration of the resins, in fact, at least a resins wash is required by a softening system to wash away any salt excess from regeneration as well as any calcium excess released by the resins during regeneration.

[0016] The volume of water flowing through the water softening resins and through the sample resins is proportionate to their quantity; for instance, if the amount of sample resins ranges from 1/30 to 1/50 of the quantity of softening resins, also the water flowing through the sample resins will be 1/30 to 1/50 of the volume of water

flowing through the water softening resins. This smaller volume of water may not be enough for ensuring a complete removal of the excess salt contained therein; in fact, a small quantity of salt left back in the sample resins is still enough to cause their shrinkage due to the osmotic pressure exerted on the resins by the salt rest not flushed away and have the sensor maintaining the warning light circuit in its closed condition.

[0017] As it is clear from the considerations and simulations performed on the sensor for detecting the resins state applied to the management of the wash cycle and regeneration in modern dishwashing machines, this condition of the salt warning light remaining on may even last for a complete cycle; in dishwashing machines with an electronic programmer, this condition can last over one wash cycle before the sensor is able to detect that salt has been added so the salt warning light is put off.

[0018] This situation leads the user to add further salt at the beginning of the next cycle; quite surprisingly he will find out that the tank is already filled with salt (it should also be noticed that salt is not necessarily performed by the same member of a family or community where the machine is installed); should the warning lamp still remain on, a service call for an improbable fault would be placed entailing relevant costs for both the user and manufacturer, above all with a considerable damage for the manufacturer's image.

[0019] Accordingly, it is the object of the present invention to solve the above drawbacks and provide a method for detecting the lack of a regenerating agent in a device for reducing water hardness as required for operation of a household washing machine, in particular a dishwasher, comprising a reliable and advantageous device for detecting the state of the water softening resins.

[0020] In this frame, a first aim of the present invention is to provide a method for detecting the lack of salt, wherein this situation is safely detected, without any delay for the user.

[0021] A second aim of the present invention is to provide a method, which can be managed by an electromechanical programmer or electronic control device.

[0022] A further aim of the present invention is to provide a system for detecting the lack of a regenerating agent in a washing machine, in particular a dishwasher, comprising a device for detecting the state of the water softening resins, which is reliable and advantageous.

[0023] According to the present invention, the above aims are reached by a method for detecting the lack of a regenerating agent in a device for reducing water hardness as required for operation of a household washing machine, in particular a dishwasher, using a sensor for detecting the state of the water softening resins, incorporating the features of the annexed claims, which form an integral part of the present invention.

[0024] Further objects, features and advantages of the present invention will become apparent from the following detailed description and annexed drawings, which are supplied by way of non limiting example, wherein:

- Fig. 1 shows schematically a view of a water softening device of a dishwasher comprising a sensor for detecting resins exhaustion, according to the present invention;
- Fig. 2 shows schematically a wash cycle of a dishwasher fitted with an electromechanical programmer, according to the present invention;
- Fig. 3 shows schematically a wash cycle of a dishwasher fitted with an electronic programmer, according to the present invention;
- Fig. 4 shows schematically a wiring diagram of a dishwasher fitted with an electromechanical programmer, according to the present invention;
- Fig. 5 shows schematically a view of a water softening device of a dishwasher comprising the sensor for detecting resins exhaustion, according to an implementation of the present invention;
- Fig. 6 shows schematically the operation diagram of the sensor for detecting the resins state of a water softener, according to the present invention;
- Fig. 7 shows schematically a wash cycle of a dishwasher fitted with an electromechanical programmer, according to an implementation of the present invention;
- Fig. 8 shows schematically a wash cycle of a dishwasher fitted with an electronic programmer, according to an implementation of the present invention.

[0025] In Figure 1 reference 1 indicates in its whole a water softening device of a dishwasher comprising a sensor for detecting the resins state according to a preferred embodiment of the present invention.

[0026] Reference 2 indicates the softening device, reference 3 indicates the sensor for detecting the resins state. The sensor 3 is mechanically and hydraulically connected to the device 2.

[0027] The sensor 3 described in the above patent application TO2000A000012 filed in the applicant's name of the present patent application is no longer described herein, whereas only its main components and functions are indicated.

[0028] The present invention is also based on the teachings described in the above patent application.

[0029] The sensor 3 has a body 4, wherein sample resins are contained and whereon a movable element containing a permanent magnet M is located (not represented in the figure). Outside the body 4 there is at least a reed indicated with 5, which is activated (ON) when subject to the magnetic field of the magnet M of the movable element. The position of the movable element derives from a shrinkage and/or expansion of the sample resins following their exhaustion and/or regeneration and/or osmotic pressure.

[0030] The movable element can be subject to additional movements upwards for facilitating an expansion and/or compaction of the sample resins during the resins regeneration and wash steps. This movement to the movable element is obtained by means of an outer coil 6 above the body 4; when the coil 6 is excited, a ferromagnetic core located on the end of a rod protruding from the movable element is drawn inside it as commonly known, moving the element upwards.

[0031] Reference 7 indicates a pipe-union for introducing the salt to obtain the brine for resins regeneration, reference 8 indicates a compartment inside the device 2, being apt for a likely housing of a float for salt lack detection.

[0032] During operation of the washing machine, as the resins gradually become exhausted and reduce their volume, the movable element of the sensor 3 goes further downwards, also displacing the magnet M contained in it to a lower level which, when it comes in line with the reed causing its closure (ON).

[0033] The various resins regeneration and wash steps are activated and/or deactivated by a closed (ON) and/or open (OFF) condition of the reed 5, i.e. corresponding to the position taken by the magnet M of the movable element with respect to the reed 5 in function of the volume of the sample resins.

[0034] The sensor steps for detecting the resins state and the condition of the reed 5 during these steps described in the above patent application are also recalled here; they are schematically represented in Fig. 6 as follows:

- step 1, which corresponds to the position of the magnet M of the movable element with the sample resins in their initial condition and the reed 5 in its open condition (OFF);
- step 2, which corresponds to the position of the magnet M of the movable element upon exhaustion of the sample resins; the reed 5 is in its closed condition (ON) being affected by the magnetic field of the magnet M of the movable element, which is displaced downwards due to a decreased volume of the sample resins. In this step a regeneration valve is activated as well as at least an on/off cycle of the coil 6;
- step 3, which corresponds to the position of the magnet M of the movable element when the sample resins during the regeneration step come in contact with the brine having a high concentration of sodium chloride (NaCl), the reed 5 is in its open condition (OFF) being no longer affected by the magnetic field of the magnet M of the movable element. This situation ensues because a further reduction of the resins volume has caused the magnet M to move farther down due to the osmotic pressure; in reality, this position is not required for the purposes of the invention described herein, since the steps 1, 2 (movable element going downwards with the sensor magnet 3) and 5 (movable element going upwards) are sufficient for using the brine detecting methods claimed by the softening system; in particular, this can be obtained fitting the body 4 of the sensor 3 with a stop to lock a further descent of the movable element following a volume reduction of the resins due to the osmotic pressure;
- step 4, which corresponds to the position of the magnet M of the movable element during the first resins wash; the reed 5 is in its closed position (ON) because of the magnet M moving upwards following a volume increase of the resins due to a reduced osmotic pressure. In this step, at least an on/off cycle of the coil 6 is activated; as indicated above, in a sensor 3 featured by a restricted stroke of the movable element, where the reed 5 is not permitted to reach the lower open position (OFF), it matches with the step 2, i.e. the reed 5 is in closed position (ON) from the time the sample resins contained in the sensor 3 are exhausted (even a partial exhaustion in a preferred embodiment) up to the time they have had an efficient wash after a complete satisfactory regeneration of the sample resins;
- step 5, which corresponds to the position of the magnet M of the movable element at the end of the resins wash; the reed 5 is in its open position (OFF) following a displacement still upwards of the magnet M due a further volume increase of the resins caused by a further decrease of the osmotic pressure.

[0035] Should the reed 5 further maintains its own closed condition (ON) after a regeneration step followed by a resins wash step, this would mean that the resins have not been regenerated, since the brine does not contain enough salt and the sample resins have not increased their volume due a constant condition as described under step 2 (exhausted resins).

[0036] As previously mentioned, this condition of the reed 5 may also be due to a poor wash of the sample resins and cause problems to the user if the resins regeneration step is performed in special moments during the cycle.

[0037] In Fig. 2 is schematically represented a wash cycle of a dishwasher fitted with an electromechanical programmer, wherein the resins regeneration step is performed during certain wash cycle steps to overcome the above problems.

[0038] Based on the diagram of Fig. 2, the regeneration of the water softening resins and sample resins of the sensor 3 is performed at about half the wash cycle instead of cycle end. Since regeneration is performed during the hot wash or straight after it, the resins of the sensor 3 are submitted after their regeneration to a wash for removing any excess salt and to a further flushing with the water intake for rinsing the crockery, so that all possible salt rests eventually left back in the sample resins are removed and the resins can go back to their orig-

inal condition.

[0039] This condition has caused the movable element with the relevant magnet M to move upwards, no longer affecting the reed 5 with its magnetic field; as a result, the reed 5 will take its open condition (OFF) at the start of the last rinse.

[0040] To avoid having the warning light on at wrong cycle times for the user, since the reed 5 takes its closed position (ON) also during the resins exhaustion step and not only due to the lack of salt, being the salt warning light S linked to the sensor reed 5 as illustrated in the wiring diagram of Fig. 4, the salt warning light L will be activated only at cycle end or better during the last rinse, so there will be enough time for the user to become aware of the warning light eventually on.

[0041] This provision is possible through an additional programmer cam, indicated with C10 in Fig. 4, which closes the circuit putting the salt warning light L in series with the reed 5 at cycle end only or better during the last rinse, as previously mentioned.

[0042] Therefore, should regeneration not have been satisfactory due to the lack of salt, the user would become aware of this condition because the salt warning light L is on at the end of the wash cycle of the dishwasher. Now, salt can be added in the special softener tank for a subsequent efficient regeneration. During the entire cycle up to the first cold rinse, the salt warning light L is not enabled by the programmer cam C10 to avoid wrong information to the user.

[0043] After a resins wash following regeneration, the reed 5 can in fact still be in its closed condition (ON) not due to a poor regeneration but rather to salt rests that have not been removed when flushing the resins; therefore, should the salt warning light L be activated at that time, it would be on and deceive the user about the brine condition.

[0044] If the sample resins of the sensor are regenerated with enough salt, the reed 5 opens (OFF) at the last rinse, since the sample resins have restored their original volume, in fact flushing the resins and the water intake for rinsing the crockery have removed any salt rests from the sample resins.

[0045] Vice-versa, in a dishwashing machine fitted with an electronic programmer having a programmer memory available, the regeneration can be performed at any time, also at the end of a wash cycle; in other words, the machine knows when regeneration is performed.

[0046] Let us assume that the regeneration is performed at cycle end as schematically illustrated in Fig. 3 and the sensor reed 5 is in its closed condition (ON). This situation (ON) can indicate a poor resins regeneration or, as previously mentioned, the presence of salt in the sample resins due to their unsatisfactory wash.

[0047] In doubt, the electronic programmer will not activate the warning light; should it ascertain at about half the subsequent wash cycle that the reed 5 is still closed (ON) after water intake for the washing, it will activate the salt warning light at cycle end.

[0048] Vice-versa, it will not activate the salt warning light should the reed 5 be in its open condition (OFF), since the previous closed position of the reed 5 was due to a salt rest in the sample resins, removed through the intake of washing water.

[0049] When the user notices at cycle end that the salt warning light is on, he/she fills the special tank of the device 2 with salt through the pipe-union 7 before starting the next wash cycle.

[0050] The electronic programmer, at half of this cycle will perform a regeneration step (either during or after the hot wash) to check the condition of the reed 5; if at the end of this unusual cycle, wherein the time of resins regeneration has been changed, the electronic programmer detects that the reed 5 is in open condition (OFF) as it should be, it is then clear to it that salt has been added; if, vice-versa, a closed condition (ON) is detected, it is clear to the electronic programmer that no salt has been added; as a result, it will activate the salt warning light again at cycle end.

[0051] In this event, the electronic programmer will check during the next cycle whether salt has been added or not, as done for the previous cycle.

[0052] The salt warning light L, if required, will be activated by the electronic programmer at cycle end only, whereas it remains deactivated during all the remaining cycle.

[0053] The regeneration step in dishwashing machines fitted with the sensor 3 for detecting the resins state is automatically activated by the sensor only when resins exhaustion has been ascertained during the step 2 of its detecting operation; therefore, according to water hardness the regeneration can be activated at every wash cycle for very hard water, or after a few wash cycles for not very hard water, as described in the above patent application.

[0054] From the above description and annexed claims the feature of the present invention are clear and also its advantages are clear.

[0055] As it can be noticed from the above description, according to the present invention the method employed for detecting the lack of salt in a water softening device comprising a sensor for detecting the resins exhaustion state, is obtained by means of a device incorporated in the washing machine.

[0056] This method allows a simple, reliable and easy detection of the lack of salt in a dishwasher.

[0057] It is obvious that many changes are possible for the man skilled in the art to the method and device object of the present invention, without departing from the novelty principles of the inventive idea.

[0058] According to a possible implementation, the device for detecting the state of resins exhaustion may be combined with a softening device comprising a float for detecting the lack of salt, as represented in Fig. 5.

[0059] In Fig. 5 the same reference numbers are used for those components that do not change with respect

to Fig. 1; reference 1A indicates the water softening device as a whole, reference 2A indicates the softening device, reference 3 indicates the sensor for detecting the resins state.

[0060] Reference 9 indicates a float for detecting the lack of salt in the softening device 2A. The float 9 has an inner permanent magnet M1 and can freely slide vertically in the compartment 7 located inside the softening device 2A in contact with the brine.

[0061] With respect to the sensor 3 for detecting the resins state, the compartment 7 is so positioned to have the magnet M1 of the float 9 involving with its magnetic field the reed 5 of the resins sensor 3 when salt is lacking in the softening device 2A. Moreover, it must be located at such a distance not to affect the behaviour of the reed 5, which indicates the position of the movable element of the sensor 3.

[0062] Also according to this embodiment, the resins regeneration step is performed in well determined times of the wash cycle, so as to overcome the problems previously indicated.

[0063] Resins regeneration in a dishwashing machine fitted with an electromechanical programmer as schematically illustrated in Fig. 7 will be performed at the same time as in the preferred embodiment previously described, i.e. at about half wash cycle. Thus, since said regeneration is performed during the hot wash or straight afterwards, the resins of the sensor 3 are submitted after their regeneration to a wash for removing any excess salt and to a further flushing with the water intake for rinsing the crockery, which will remove all possible salt rests from the sample resins, and let them go back to their original condition.

[0064] This condition causes the movable element with the relevant magnet M to move upwards and no longer affect the reed 5 with its magnetic field; as a result, the reed 5 will take its open condition (OFF) at the beginning of the last rinse.

[0065] According to this implementation the salt warning light L will be activated by the cam C10 both at cycle end and at the start of the next cycle, so the user has enough time to become aware of the warning light eventually on.

[0066] The lack of salt will be signalled by the salt warning light L activated by the magnet M1 of the float 9, since the latter has been displaced downwards due to a minor brine concentration, involving the reed 5 with its magnetic field and bringing it to its closed condition (ON).

[0067] Now, the user adds salt in the special softener tank at the beginning of the next cycle, the brine increases its concentration and the float moves upwards out of reach of the reed 5 of the sensor 3; the reed 5 being no longer affected by the magnetic field of the float will take its open condition (OFF), cutting the circuit of the salt warning light L.

[0068] The coil 6 is activated at cycle start to avoid that the sample resins of the sensor 3 not yet regenerated at cycle start may affect the salt warning light L after performing a salt filling up; activation of the coil 6 causes the magnet M of the movable element of the sensor 3 to move upwards and no longer affect the reed 5 with its magnetic field. Thus, the salt lack is only signalled depending on the position of the magnet M1 of the float 9, whose magnetic field affects the reed 5 and causes its closure.

[0069] Before deactivating the coil 6, the cam C10 will cut the circuit of the salt warning light L to avoid that the magnet may affect the reed 5 following a release of the movable element and cause its closure with the salt warning light L turning on also after the filling up with salt, as previously mentioned.

[0070] It is obvious that when no salt filling up is performed, the salt warning light L will go on again at the end of the wash cycle and at the start of the next one.

[0071] Referring to a dishwashing machine fitted with an electronic programmer as schematically represented in Fig. 8, if the electronic programmer detects the reed 5 in its closed condition (ON) at cycle end, independently from the cycle time at which regeneration is performed, it will check whether this condition is due to a poor wash of the sample resins of the sensor 3 or to the lack of salt, by shortly activating the coil 6 of the sensor 3. As previously mentioned for a machine fitted with an electromechanical programmer, activation of the coil 6 causes the magnet M of the movable element of the sensor 3 to move upwards and no longer affect the reed 5 with its magnetic field. Should the reed 5 during the activation of the coil 6 still be in its closed condition (ON), this would mean that this position of the reed 5 is due to the magnet M1 of the float 9 having moved downwards due to a minor brine concentration caused by the lack of salt, whereby the electronic programmer will activate the salt warning light L for signalling it to the user.

[0072] At the beginning of the next cycle, the electronic programmer will perform the same check by shortly activating the coil 6 of the sensor 3. If the user has performed a salt filling up, the programmer detects the open condition of the reed 5, since the float 9 with its relevant magnet M1 has been displaced upwards and the reed 5 is no longer affected by its magnetic field; with this condition of the reed 5, the electronic programmer will put the salt warning light L off.

[0073] Vice-versa, should the programmer detect the reed 5 still in its closed condition (ON) when checking at cycle start, it would keep the salt warning light L on, so the user knows that salt has to be filled up.

[0074] This embodiment, both with an electromechanical programmer and electronic programmer allows the use of the reed 5 and relevant electric circuit of the sensor 3 also when a float with magnet is employed for detecting the lack of salt. Moreover, this embodiment also allows putting off the salt warning light without delay with respect to the salt filling up.

[0075] Another implementation may be the use of two reeds 5 located on the same strip of the sensor 3, with

a float device with magnet for detecting the lack of salt.

[0076] One of the two reeds 5 will be used by the sensor 3 for detecting the resins state and activate the various resins regeneration and wash steps. The second reed 5 will be provided to detect the position of the float magnet indicating the lack of salt.

[0077] This implementation can be used indifferently on machines with an electromechanical and/or electronic programmer, as well as also with a wash cycle providing regeneration at cycle end. In fact, the salt warning light will be linked to the reed for detecting the float position and activated only in case of actual lack of salt.

[0078] This solution ensures a reduction of manufacturing costs, since the two reeds located on the same strip require less welding processes, i.e. one process will be enough to weld both reeds on the same strip using a common wiring connection for both.

[0079] A further implementation can be an acoustic signal indicating the lack of salt in replacement of and/or in combination with the luminescent signal of a warning light.

[0080] It is obvious, anyway, that in this frame various implementations are possible for the man skilled in the art to the present invention, both for machines with an electronic control system and machines with an electromechanical control system.

Claims

1. A method for detecting the lack of a regenerating agent in a household washing machine, in particular a dishwasher comprising:

   - a device (1;1A) for water softening containing resins (R), which reduce their softening capacity depending on the volume of water being treated, said softening device (1;1A) comprising a container for said regenerating agent;
   - a sensor (3) for detecting the state of said resins, said sensor (3) containing sample resins (RC), whose volume decreases depending on their exhaustion level, where said sensor (3) comprises a movable element capable of taking at least a first operating position, wherein said movable element delimits a chamber containing said sample resins (RC), the position of said movable element being determined by a magnetic sensor (5);

   said method providing at least a regeneration step of the softening capacity of said resins (R;RC), during which an aqueous solution containing said regenerating agent is conveyed to said resins (R;RC) and at least a wash step of said resins (R;RC) after said regeneration,
   characterized in that, said regeneration and wash steps of said resins are followed at least by a water intake in the washing machine before activating a signal to indicate the lack of said regenerating agent.

2. A method according to claim 1, **characterized in that** a signal of the lack of said regenerating agent is activated only when said sample resins (RC) have not reached a preset volume and said sensor (3) is in a closed condition (ON) after said water intake.

3. A method according to claim 2, **characterized in that** said signal of the lack of said regenerating agent is activated at the end of a wash cycle, in particular during the last rinse.

4. A method according to claim 2, **characterized in that** said signal of the lack of said regenerating agent is activated at the end of a wash cycle and at the start of the next wash cycle.

5. A method according to claim 2, **characterized in that** said signal of the lack of said regenerating agent is activated at the end of a next wash cycle after checking that said sensor (3) is still in its closed condition (ON), said check being substantially performed at half said wash cycle.

6. A method according to claim 2, **characterized in that** at least an upwards movement of said movable element is obtained before activating said signal, in order to detect the closed condition (ON) of said sensor (3).

7. A method according to the previous claims, **characterized in that** following said signal of the lack of said regenerating agent, the latter is filled up at the start of the wash cycle subsequent to the cycle with said signal.

8. A method according to claim 7, **characterized in that** it controls performance of said filling up, checking at the end of the wash cycle that the signal of the lack of said regenerating agent is deactivated from the open condition (OFF) of said sensor (3).

9. A method according to claim 7, **characterized in that** it controls performance of said filling up, checking through activation of a regenerating and resins wash step performed at half said wash cycle, that at cycle end said signal of the lack of said regenerating agent is deactivated from the open condition (OFF) of said sensor (3).

10. A method according to claim 7, **characterized in that** it controls performance of said filling up, checking through activation of at least an upwards movement of said movable element of said sensor (3),

that said signal of the lack of said regenerating agent is deactivated from the open condition (OFF) of said sensor (3).

11. A system for detecting the lack of a regenerating agent in a household washing machine, in particular a dishwasher, comprising:

- a device (1;1A) for water softening containing resins (R) which reduce their softening capacity depending on the volume of water being treated, said softening device (1;1A) comprising a container for said regenerating agent;
- a sensor (3) for detecting the state of said resins, said sensor (3) containing sample resins (RC), whose volume decreases depending on their exhaustion level, a first magnetic element (M), in particular a permanent magnet, capable of changing its own position depending on the volume change of said sample resins (RC), at least a first magnetic sensor (5) for detecting the position of said first magnetic element (M),

said system providing at least a regeneration step of the softening capacity of said resins (R;RC), during which an aqueous solution containing said regenerating agent is conveyed to said resins (R;RC), at least a wash step of said resins (R;RC) after said regeneration,
characterized in that, it provides means (C10,L, 6,9) being apt to signal the lack of said regenerating agent, provided said first magnetic sensor (5) is in its closed condition (ON) after having performed a regeneration and wash step of said resins (R;RC) followed by a water intake in the washing machine.

12. A system according to claim 11, **characterized in that** said means (C10,L,6;9) comprise a cam (C10) of an electromechanical programmer, being apt to activate said signal of the lack of said regenerating agent.

13. A system according to claim 11, **characterized in that** said means (C10,L,6;9) comprise an electromagnetic coil (6), being apt to change the position of said first magnetic element (M).

14. A system according to claim 11, **characterized in that** said means (C10,L,6;9) comprise a luminescent (L) and/or acoustic signalling means.

15. A system according to claim 11, **characterized in that** said means (C10,L,6;9) comprise a float (9), in particular said float (9) being inserted in a seat (7) of said softening device (1;1A) in contact with said regenerating agent.

16. A system according to claim 15, **characterized in that** said float (9) comprises a second permanent magnet (M1).

17. A system according to claim 11, **characterized in that** said sensor (3) comprises a second magnetic sensor (5), being apt to be activated by said second permanent magnet (M1) of said float (9) for signalling the lack of said regenerating agent.

18. A system according to at least one of the previous claims, **characterized in that** said system comprises an electromechanical type programmer, being apt to manage the signals produced by said sensor (3), in particular for controlling the lack of said regenerating agent.

19. A system according to at least one of the previous claims, **characterized in that** said system comprises an electronic type programmer, being apt to manage the signals produced by said sensor (3), in particular for controlling the lack of said regenerating agent.

20. A system according to claim 11, **characterized in that** said sensor (3) comprises a body (4) containing said sample resins (RC), where said first magnetic element (M) is capable of changing its own position depending on the volume change of said sample resins (RC) and where said body (4) is hydraulically connected to said softening device (1;1A), so that the water used for said softening steps and the water used for said restoring steps is brought in contact with both said sample resins (RC) and said softening resins (R).

21. A household washing machine, in particular a dishwasher, which uses the method and/or system for detecting the lack of a regenerating agent, according to one or more of the previous claims.

22. A household washing machine, in particular a dishwasher, which implements the method according to one or more of the previous claims.

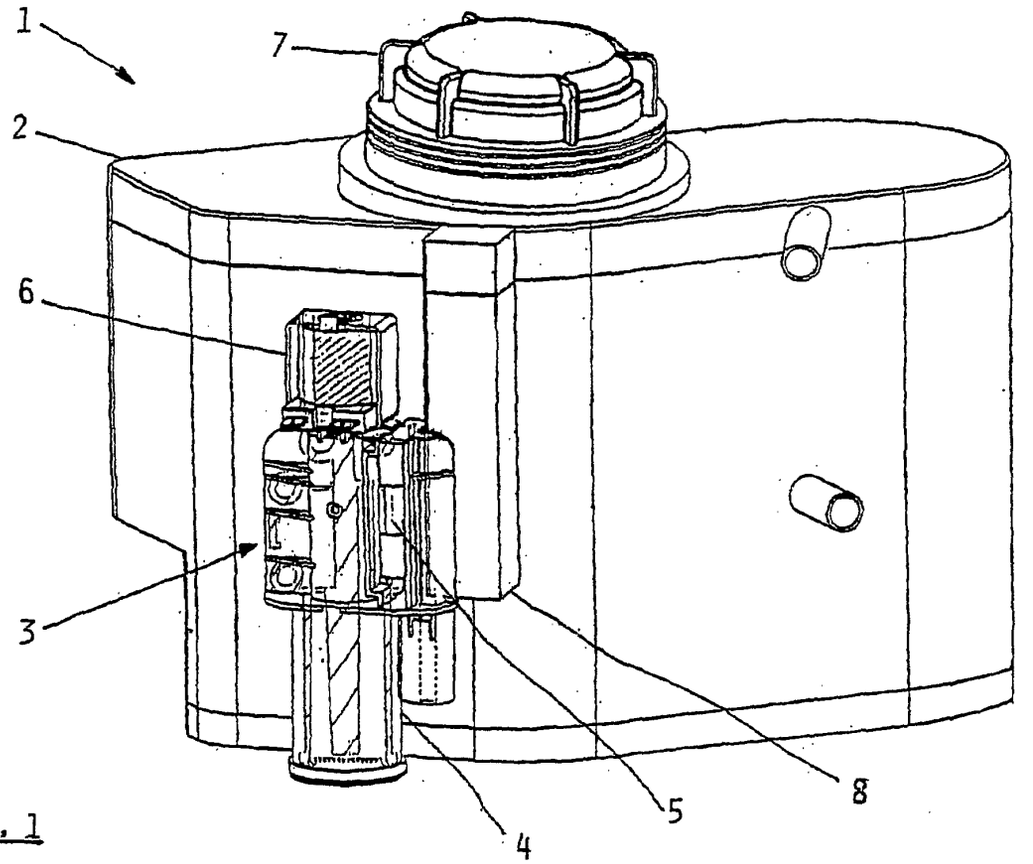

1
2
3
4
5
6
7
8

FIG. 1

FIG. 2

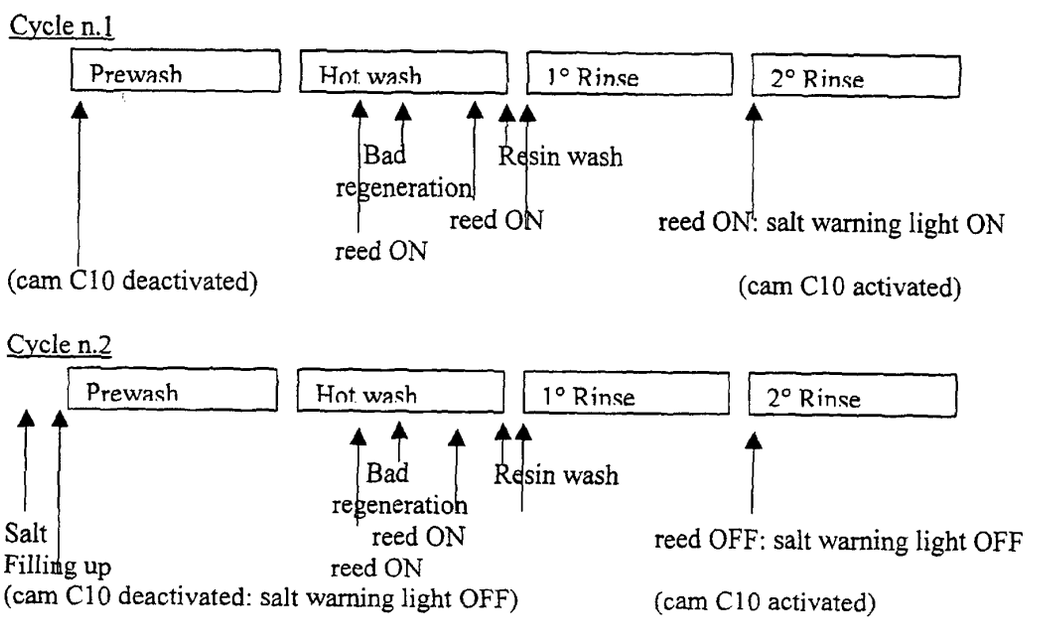

Cycle n.1
Prewash
Hot wash
1° Rinse
2° Rinse
Bad regeneration
reed ON
Resin wash
reed ON
reed ON: salt warning light ON
(cam C10 deactivated)
(cam C10 activated)
Cycle n.2
Prewash
Hot wash
1° Rinse
2° Rinse
Salt
Filling up
Bad regeneration
reed ON
reed ON
Resin wash
reed OFF: salt warning light OFF
(cam C10 deactivated: salt warning light OFF)
(cam C10 activated)

FIG. 3

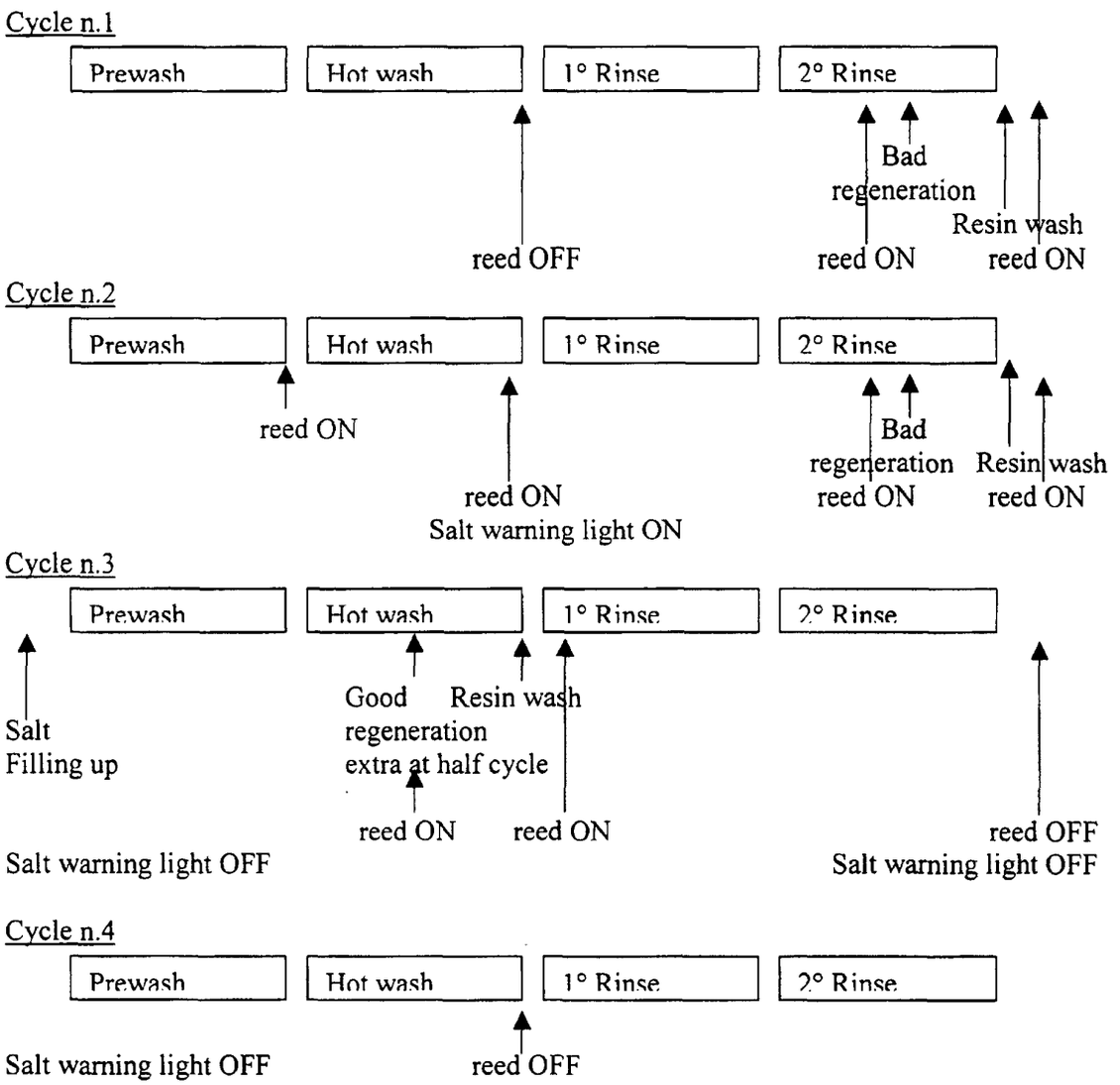
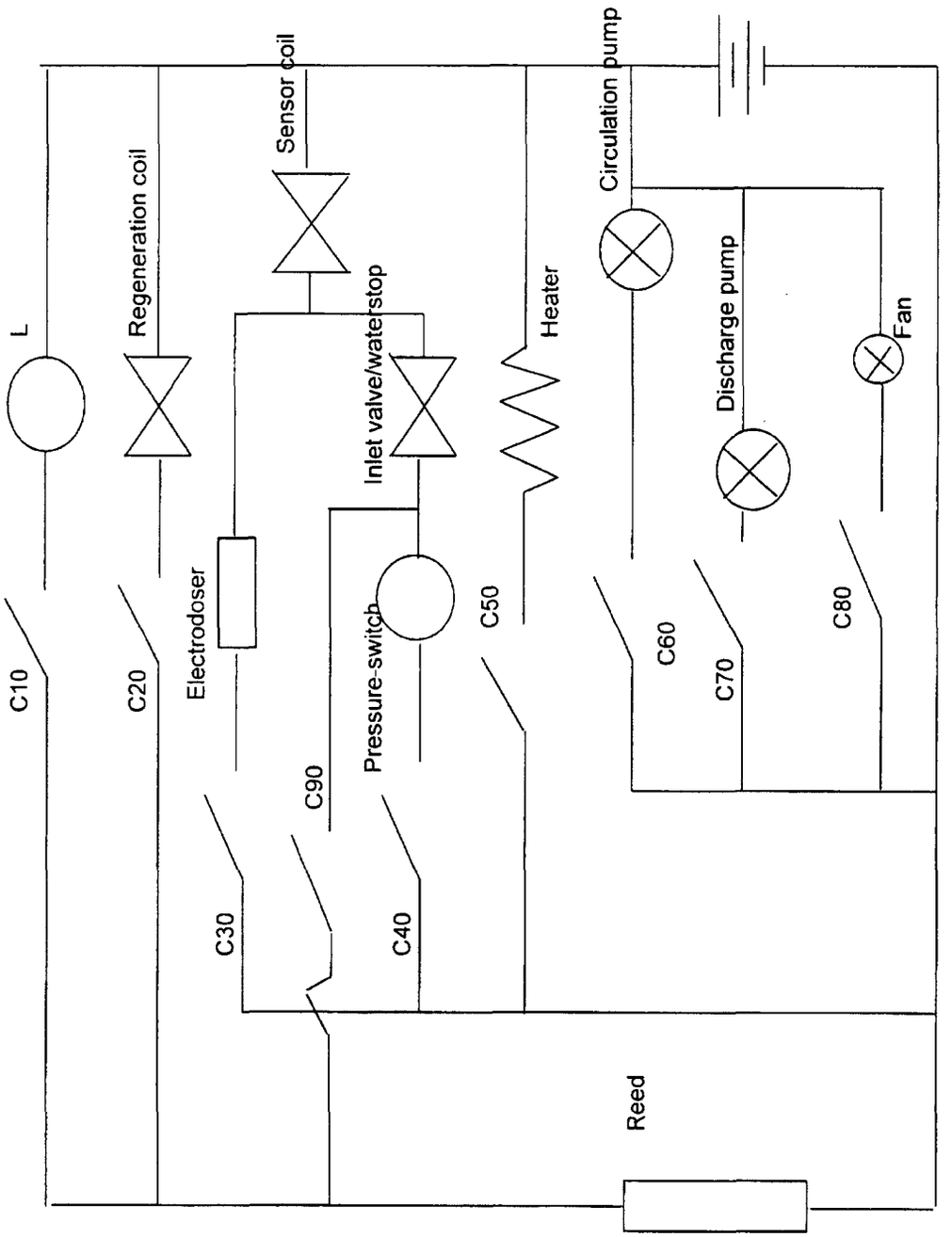

Cycle n.1
Prewash
Hot wash
1° Rinse
2° Rinse
reed OFF
Bad regeneration
reed ON
Resin wash
reed ON
Cycle n.2
Prewash
Hot wash
1° Rinse
2° Rinse
reed ON
reed ON
Salt warning light ON
Bad regeneration
reed ON
Resin wash
reed ON
Cycle n.3
Prewash
Hot wash
1° Rinse
2° Rinse
Salt
Filling up
Salt warning light OFF
Good regeneration extra at half cycle
Resin wash
reed ON
reed ON
reed OFF
Salt warning light OFF
Cycle n.4
Prewash
Hot wash
1° Rinse
2° Rinse
Salt warning light OFF
reed OFF

FIG. 4


L
Regeneration coil
Sensor coil
Circulation pump
Heater
Inlet valve/waterstop
Discharge pump
Fan
Electrodoser
Pressure-switch
C10
C20
C30
C40
C50
C60
C70
C80
C90
Reed

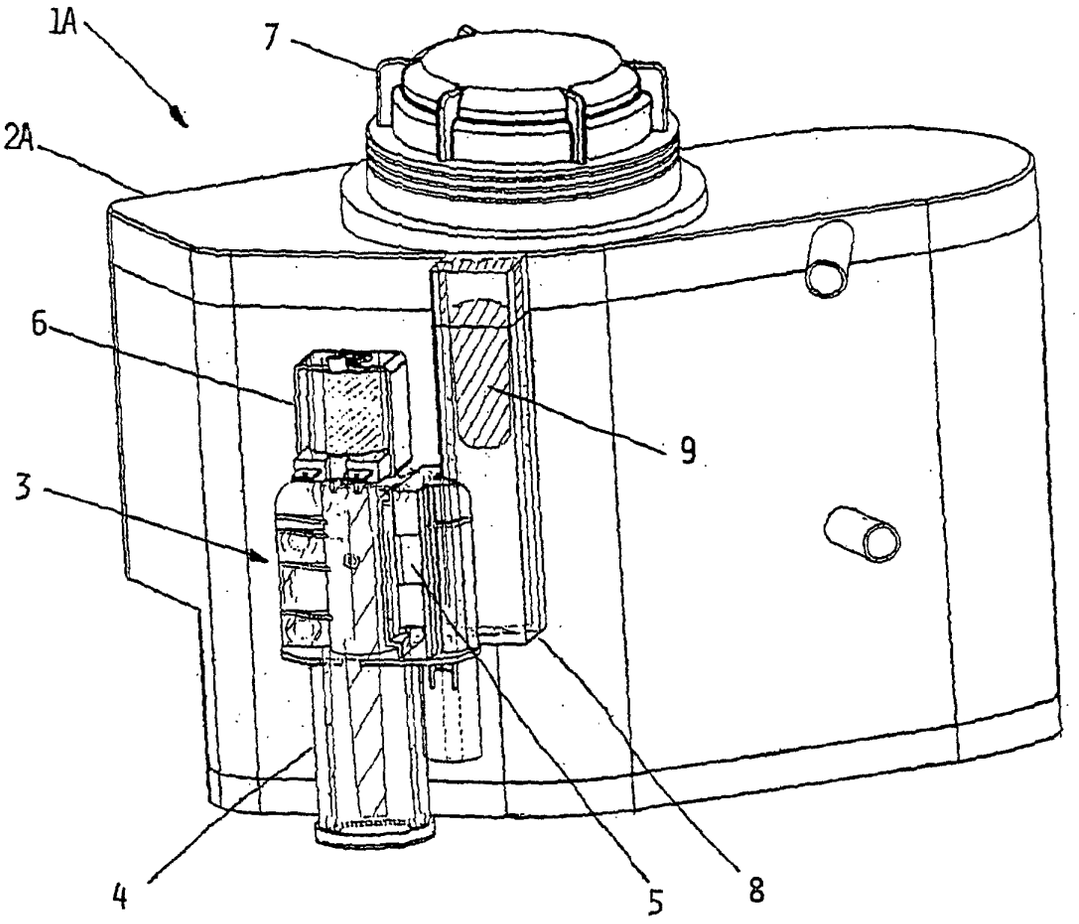


FIG. 5

FIG. 6

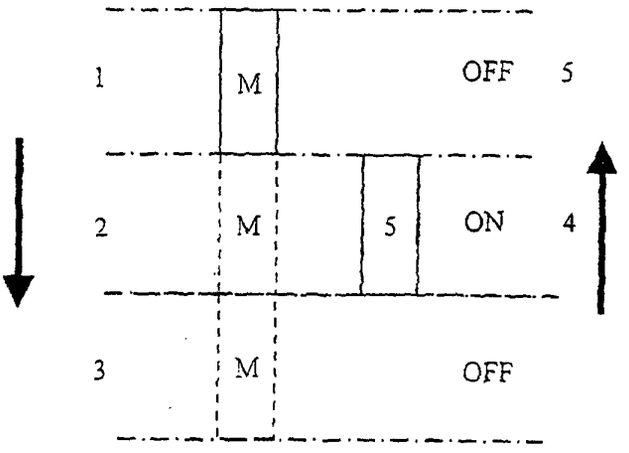


FIG. 7

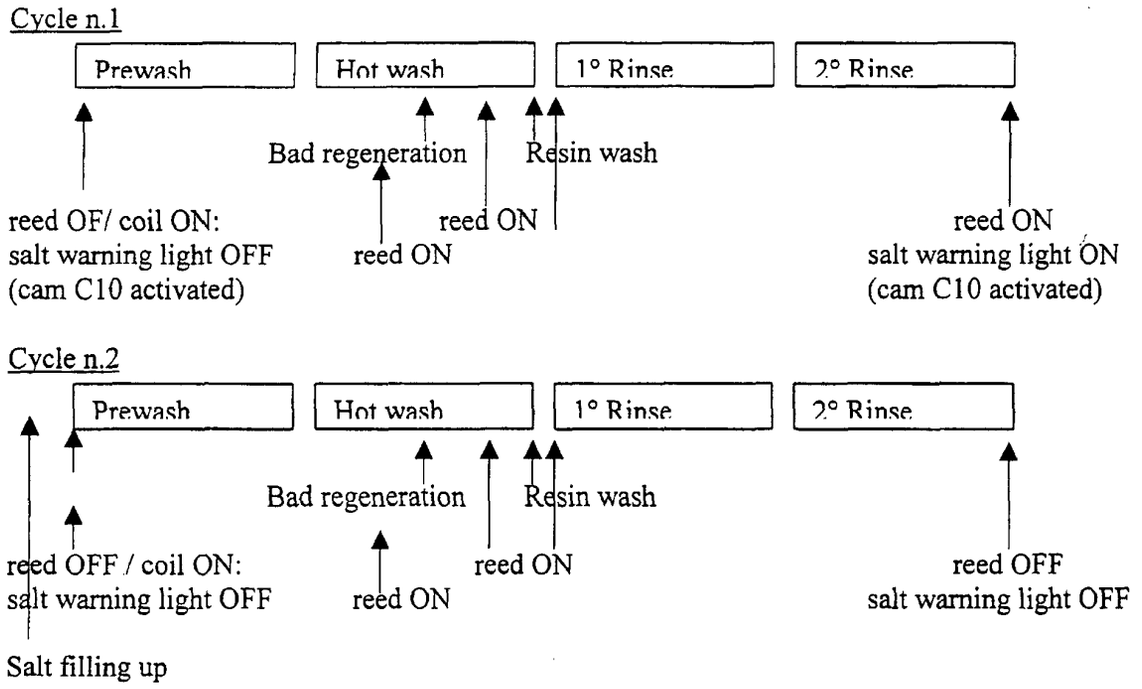
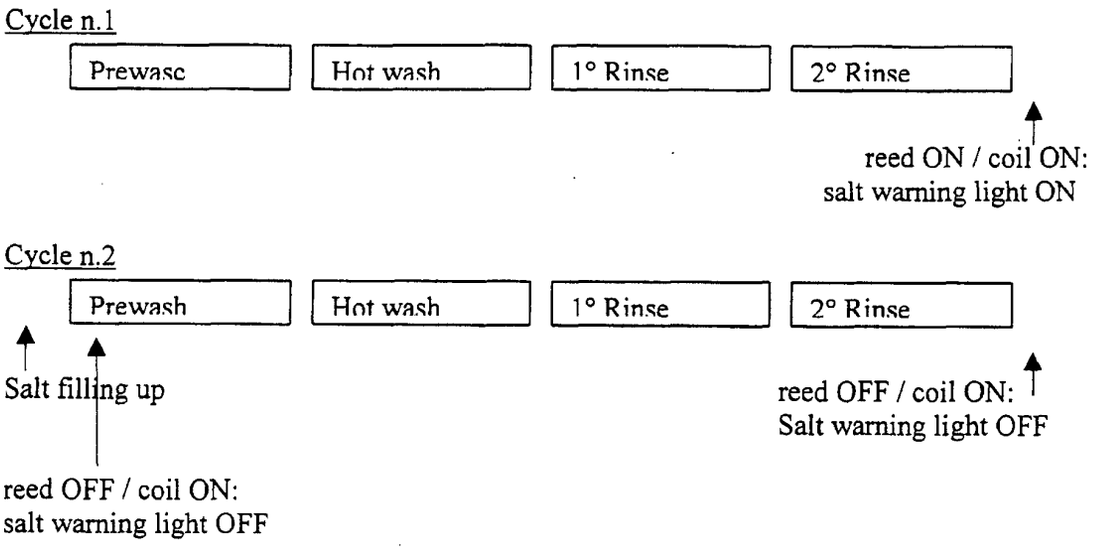

Cycle n.1
Prewash
Hot wash
1° Rinse
2° Rinse
Bad regeneration
Resin wash
reed OF/ coil ON:
salt warning light OFF
(cam C10 activated)
reed ON
reed ON
reed ON
salt warning light ON
(cam C10 activated)
Cycle n.2
Prewash
Hot wash
1° Rinse
2° Rinse
Bad regeneration
Resin wash
reed OFF / coil ON:
salt warning light OFF
reed ON
reed ON
reed OFF
salt warning light OFF
Salt filling up

FIG. 8


Cycle n.1
Prewasc
Hot wash
1° Rinse
2° Rinse
reed ON / coil ON:
salt warning light ON
Cycle n.2
Prewash
Hot wash
1° Rinse
2° Rinse
Salt filling up
reed OFF / coil ON:
Salt warning light OFF
reed OFF / coil ON:
salt warning light OFF