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IN COMBINATION WITH A WASHING MACHINE
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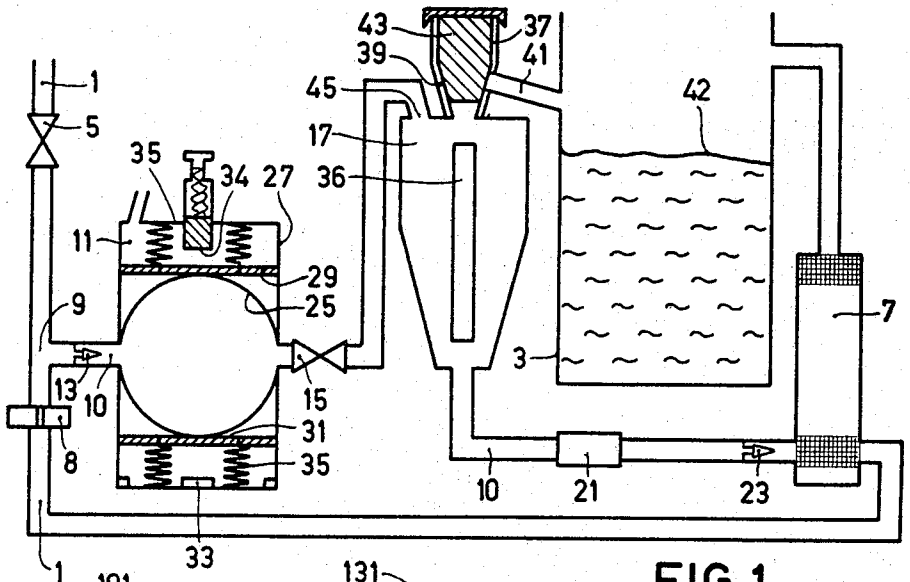

FIG. 1

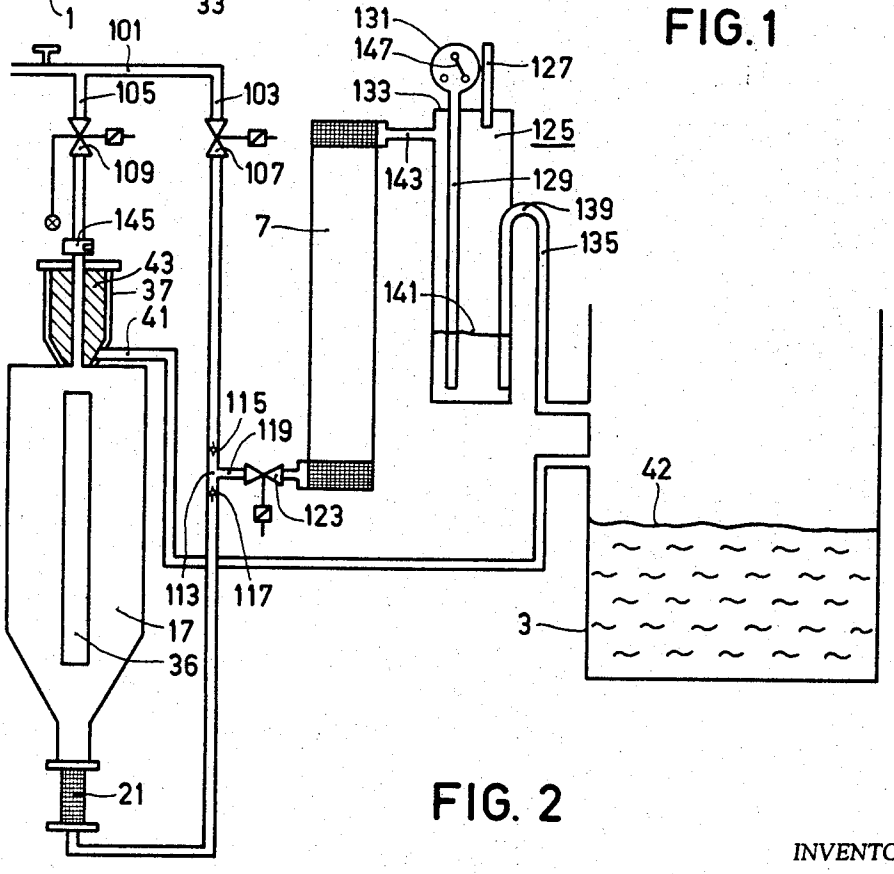

FIG. 2

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APPARATUS FOR REGENERATING A WATER SOFTENER IN COMBINATION WITH A WASHING MACHINE

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2 Claims. (Cl. 210—97)

ABSTRACT OF THE DISCLOSURE

Apparatus for automatically regenerating the ion exchanger of a water softener for washing and rinsing machines wherein for forming a measured amount of the regenerator liquid, there is provided an adjustable accumulator having an elastic bladder member for receiving fresh water which measured amount of water is subsequently added to the exchange ion salt and supplied to the water softener.

The invention relates to automatic regeneration of ion exchangers in water softeners for washing and rinsing machines, in particular for dish washers, in which, regenerating, a salt solution having a predetermined concentration is prepared in a container filled with salt, and then supplied to the softener.

It is known to regenerate an ion exchanger by means of a household salt solution. In a known manually operated device the salt solution is sucked into the water softener out of a container arranged above the device. In the known automatic devices the fresh water required for regeneration is passed through the salt filling of a storage container by means of a diaphragm pump. In the salt storage container, the water as it flows through the salt container dissolves the salt which then rinses the water softener.

Because the first-mentioned method is cumbersome, it is performed by the user of the machine only when regeneration is urgently required. In this case the exchanging material may be exhausted too strongly and cannot be regenerated effectively. The second method of regenerating requires a greater amount of salt. In addition the pipe system requires nozzle discs or throttle discs, however such devices cannot prevent variations in the concentration of the salt solution because of the inevitable fluctuating water pressure.

It is also known to use a dosing pump for placing water in the regeneration system. Such a pump is satisfactory in operation, it is true, but it is expensive for the requirements imposed in household appliances.

The drawbacks of the known methods of automatically regenerating the ion exchanger in water softeners are avoided according to the invention in that a quantity of salt solution, having a maximum concentration which is dependent upon the hardness of the water to be softened, and which is smaller than the capacity of the water softener is fed, after the machine has performed one or a few operations, upwards into the water softener, as is the case with the normal water supply to be softened. The regenerating salt solution remains in the softener until it is rinsed away by the fresh water flowing into the machine.

Because a salt solution having a maximum concentration is used, and the solution is supplied to the softening apparatus in an exactly measured quantity, the quantity of salt available for regeneration is accurately fixed. Since the hardness of the water in the district

where the machine is located is known and the admissible residual hardness of the water stated by the manufacturer are known, the extent of exhaustion of the ion exchange media can be adequately compensated.

In the ion exchange mass the extent of exhaustion decreases in the direction of flow through the softener i.e. exhaustion is greatest at the inlet to the softener. Accordingly, a calcium decline is formed which has to be compensated for. This compensation is effected, according to the invention, by admitting the salt solution only into the lower part of the apparatus. The calcium ions deposited on the ion exchange mass are exchanged by the sodium ions. For the said exchange so many sodium ions are available as are required. As a result of diffusion the sodium ions move above the filling height of the salt solution. This upward migration and the said compensation measure are further aided according to the invention whereby the ion exchange mass in the softener is first pushed upwards by the strongly concentrated salt solution flowing into the softener. After the supply of the salt solution is completed the ion exchange mass moves downwardly by gravity.

The strongly concentrated saturated salt solution is preferably prepared automatically in a pipe extending parallel to the supply of fresh water and is kept ready until required.

In order that the invention may readily be carried into effect two embodiments thereof will now be described in greater detail, by way of example, with reference to the accompanying drawings, in which

FIGURE 1 is a schematic representation of a regeneration device preceding the water softener.

FIGURE 2 is a similar view of a regeneration device succeeding the water softener.

In the water supply pipe **1** for the tub **3** of for example a dish washer (not shown) an electromagnetic valve **5** is arranged which can be operated by means of an "on," "off" switch (not shown) of the dish washer. When the valve **5** is opened, fresh water flows through the pipe **1** into the tub **3** through a water softener **7** arranged in the line. A restriction **8** produces a given desired dynamic pressure at an off tap **9** which, viewed in the direction of water flow, precedes the restriction **8**.

A pipe **10** from tap **9** is connected to a pressure container **11**. Fresh water which has flowed into the pressure container **11** cannot flow back out of it since a check valve **13** is arranged between the tap **9** and the container **11**. An electromagnetic valve **15** and a storage container **17** for salt are connected via conduit **10** to the fresh water pressure container **11**. This salt storage container **17**, in the direction of flow, is succeeded by exchangeable sieves or filters **21**, and through a second check valve **23**, to the water softener **7**.

While filling the tub **3**, fresh water which is under dynamic pressure flows through the pipe **1**, tap **9** and pipe **10** for simultaneously filling a bladder **25** in the container **11**. This bladder consists of a flexible material and is enclosed by a cylindrical vessel **27**. The volume of bladder **25** can be varied by means of two members **29** and **31**. Member **31** can be compressed against the fixed stop **33** at the bottom of the vessel, and member **29** is moved against an adjustable stop member **34** at the top of the vessel **27**. When water flows into the bladder **25**, it will expand and engage the members **29** and **31** of the vessel **27**. Filling of bladder **25** is ended as soon as the water pressure in the bladder **25** is equal to the pressure of the water at tap **9** and the members **29** and **31** have been forced away as far as possible from the inlet and outlet respectively. Springs **35** which support the members **29** and **31** are proportioned so that when the bladder **25** is filled members **29** and **31** are forced against the stop members **33** and **34** respectively. The pressure must at any rate

be so large that it is capable of filling the vessel completely with water against the forces of all the springs **35**. A pneumatic pressure accumulator may be used instead of the device illustrated.

The water which has flowed into the bladder **25** remains stored during the working cycles of the machine since it cannot escape and is constantly under pressure even when the electromagnetic valve **5** has shut off the water supply. The electromagnetic valve **15** is opened either by a particular order from the cycling device of the machine or when the machine is turned off. The bladder **25** and the members **29** and **31** force the water out of the container **11** which then flows through valve **15** into the top of the salt storage container **17**. This container **17** has the shape of a bottle with its neck downward and a top inlet. This shape and the downward direction of flow ensure that the salt concentration is uniform and a maximum. Thus a maximum concentrated salt solution, in a predetermined quantity, flows through the check valve **23** which is open in this direction of flow and into the softener **7**. To ensure that no solid constituents of the salt enter the softener, exchangeable sieves or filters are arranged in the pipe at an easily accessible point.

The quantity of salt solution admitted to the softener only fills the lower part of the softener **7**. When the salt solution flows into the apparatus it first pushes the ion exchange mass upwardly in the softener. When the regeneration charge is completed, the ion exchange mass is forced down by gravity, thus upwardly displacing part of the salt solution. Thus when the quantity of the salt solution is correctly adjusted, a sodium-buffer remains in the upper part of the ion exchange mass.

The concentrated salt solution remains in the softener **7** until a new working cycle of the machine is initiated by valve **5** and fresh water is introduced into the tub **3** of the machine through the pipe **1**. The small quantities of salt which flow out of the softener **7** into the tub are of no significance. The water flowing through the pipe **1** into the softener **7** cannot enter the salt storage vessel in a reverse direction since the check valve **23** remains closed in this direction of flow.

The salt quantity in the container **17** can be read on an inspection glass **36** in the wall of the container. Therefore the container is preferably arranged directly on an outer wall of the dish washer.

For refilling the salt container a filling cap **37** is provided which is accessible from the outer wall of the machine. The lower part **39** of the said filling cap **37** is conical and is connected with an overflow pipe **41**, which empties into the tub **3**, located above the permissible filling level **42**. When filling the container **17** with salt any excess of salt solution in the regeneration system may flow away to the tub **3**. A stopper **43** for the filler cap **37** closes the overflow pipe **41**.

It is important that the water supply aperture **45** in the salt container **17** is provided at the uppermost part of the container **17**. Only in this case is it ensured that the regeneration process is performed without disturbance.

In the embodiment shown in FIGURE 1 the salt dosing takes place before the softener whereas in FIG. 2, this is effected immediately after the softener. In the embodiment shown in FIGURE 2 the fresh water supply pipe **101** is divided, immediately after entering the machine, into two parallel supply pipes **103** and **105**. The supply pipe **103** is closed by means of an electromagnet valve **107**, while the supply pipe **105** is provided with a similar valve **109**. A salt storage container **17** is connected with the supply pipe **105** which corresponds to the container **17** of FIGURE 1 and through which the fresh water flows downward. After the supply pipes **103** and **105** unite at point **113** where check valves **115** and **117** respectively are arranged. These check valves prevent the liquids of the pipes **103** and **105** from entering the parallel pipes **105** and **103** respectively.

In the common line **119** between the junction **113** and the water softener **7** a further electromagnetic valve **123** is arranged which is always opened when either one of the valves **107** or **109** is opened. A dosing device **125** through which water flows upwardly, is connected to the water softener. This dosing device, which consists of a cylindrical vessel, is opened at the top by means of a vent pipe **127**. The measuring tube **129** of a measuring drum **131** extends from the lid **133** of the dosing device **125** to nearly the bottom thereof. A switch **147** turns "off" valve **123** thus stopping the flow of salt water to the softener **7** when the water reaches a given height in the dosing device **125**. The outlet of the dosing device **125** is a siphon **135** which empties into the tub **3** of the dish washer. The overflow pipe **139** of the siphon **135** is arranged so that it is above the highest possible filling height **42** in the tub **3** and above the highest possible measuring filling height **141** in the dosing device **125** but below the supply pipe **143** of the dosing device **125**.

The front of the salt storage container **17** again as before is provided with an inspection glass **36** sealing member **43** in a filling cap **39** through which member the supply pipe **105** is passed. To reduce the rate of flow a restriction **145** may be provided in the supply pipe **105**.

Fresh water is supplied to the tub **3** when the valve **107** in the supply pipe **103** is opened by the control mechanism of the machine. At the same time the valve **123** also is opened. Fresh water therefore enters the softener **7** through the pipes **103** and **119**. The water flows from the softener through the dosing device **125**, into the siphon **135** and into the tub **3**. When the desired filling height **42** in the tub is reached, the valves **107** and **123** are closed.

When the washing and rinsing operations are completed, the magnetic valves **109** and **123** open. As a result of this fresh water flows into the salt storage container **17** and through the connection pipe **119** into the softener **7**. However, as before, the water may be supplied beforehand to the salt storage container **17** so that it is already filled with a maximum salt solution concentrated, which is forced into the softener **7** by a pressure accumulator **27**. In this case (no pressure accumulator) the rate of flow depends upon the restriction **145**.

The salt solution flowing into the softener **7** displaces the water contained therein and transports it to the dosing device **125** through the supply pipe **143**. As the height of water in the dosing device **125** increases, an air column is compressed in the measuring tube **129**. At a previously adjusted pressure the measuring drum **131** connected to the measuring tube **129** supplies a switching order, by means of a contact member **147**, as a result of which the valves **109** and **123** are closed. This switching order is produced when the filling height **141** is just below the height of the overflow **139** of the siphon **135**.

At the beginning of a new working cycle of the machine the valves **107** and **123** are opened again. The fresh water flowing into the softener **7** through the pipes **103** and **119** rinses away the kitchen salt still present in this softener into the tub **3**. The small quantities of salt present in the tub **3** have no adverse influence.

What is claimed is:

1. Apparatus having a tub and an ion-exchange water softener means; the combination comprising a fresh water source conduit means connected with said source for supplying fresh water to said tub by way of said water softener, a second parallel conduit means connected with said source and the inlet end of said water softener, said second conduit means including regenerator means having a salt container, said salt container having a water inlet at its extreme upper end and an outlet at its extreme lower end, valve means connected with said inlet for supplying fresh water thereto, said outlet being connected with said water softener at the normal inlet thereto, and measuring means included in said regenerator means for measuring a quantity of fresh water for said salt container, said measuring means comprising an adjustable pressure accumulator member having an elastic bladder member for

receiving fresh water from said source and valve means connected with said accumulator including said valve means connected with said inlet.

2. Apparatus having a tub and an ion-exchange water softener means; the combination comprising a fresh water source conduit means connected with said source for supplying fresh water to said tub by way of said water softener, a second parallel conduit means connected with said source and the inlet end of said water softener, said second conduit means including regenerator means having a salt container, said salt container having a water inlet at its extreme upper end and an outlet at its extreme lower end, valve means connected with said inlet for supplying fresh water thereto, said outlet being connected with said water softener at the normal inlet thereto, and measuring means included in said regenerator means for measuring a quantity of fresh water for said salt container, said

measuring means comprising a container interconnected with the outlet side of said water softener and the inlet of said tub, said container having siphon means therein defining the outlet of said container, and pressure sensing means connected with said container for closing the said inlet valve connected with said salt container.

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