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(54) Method of regenerating a water-softening installation for an automatic washing machine or dishwasher

(57) The invention relates to a water-softening installation for an automatic washing machine or dishwasher, in which the wash or rinse container (10) is connected with a water softener (16) filled with active resin (17), into which softener, in intake phases, fresh water can be led for softening via a software-driven intake valve (1), a storage container (2) and a water supply pipe and into which saline solution (7) for regenerating the resin can be led, by means of a software-driven regeneration valve (M), from a saline solution container (7) which is supplied with fresh water from the storage container (2), with, in the regeneration phase, activation of the regeneration valve (14) being followed by at least brief activation of the intake valve (1). The regeneration process is improved and optimized by the fact that a non-return valve (20) is connected after the regeneration valve (14) between the storage container (2) and the saline solution container (7) and this non-return valve (20) is only permeable in the direction towards the water softener and at the outlet side is connected with the entrance of the water softener and the water supply pipe connected thereto, and by the fact that, in the regeneration phase, when the intake valve is opened and the regeneration valve remains closed, an air-pressure pulse occurs in the water supply pipe.

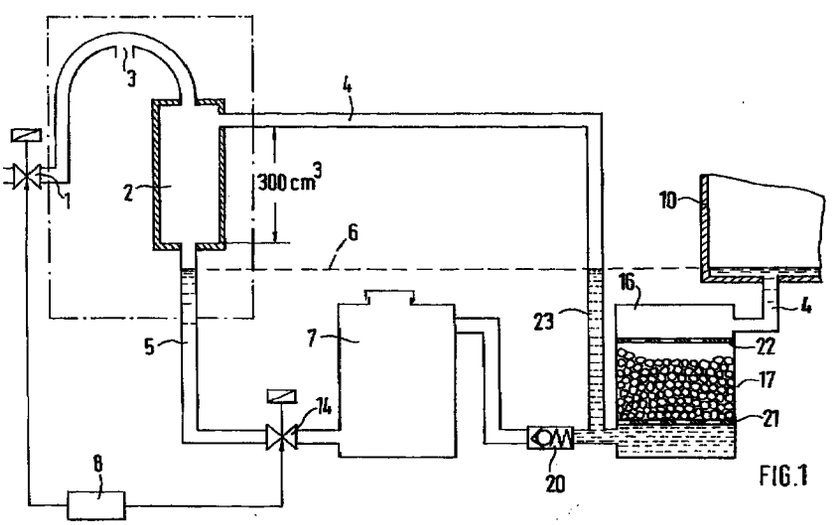

FIG.1

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Description

The invention relates to a method of regenerating a water-softening installation for an automatic washing machine or dishwasher, which has a wash or rinse container connected to a water container which is filled with active resin and into which fresh water can be led for softening in intake phases via a software-driven intake valve, a storage container and a water supply pipe and into which saline solution for regenerating the resin can be led from a saline solution container by means of a software-driven regeneration valve, a non-return valve being connected after the regeneration valve between the storage container and the saline solution container, said regeneration valve being permeable only in the direction towards the water softener and connected on the outlet side with the entrance of the water softener and of a water supply pipe connected electrically to it and taken from the storage container, the outlet of the storage container being arranged above the saline solution container and the water softener in such a way that, when the intake valve is open, fresh water can only be led into the water softener via the water supply pipe when the storage container is full.

An automatic washing machine with a regeneration phase of this kind is known from EP 0 496 957 B1. In the first part of the regeneration phase (intake valve closed, regeneration valve open) when fresh water stored in the storage container is applied, a pre-measured amount of saline solution is led from the saline solution container into the water softener. In the second part of the regeneration phase (intake valve open, regeneration valve closed) an additional amount of fresh water is led into the water softener. The water softener has a total inner area that is as big as the volume of the resin poured into it, plus some free space. The sum of the measured saline solution and of the above-mentioned additional amount of fresh water must be substantially as big as the total free space in the water softener, so that in the water softener the process of regeneration is improved by a kind of stirring or mixing effect. In this connection it should be noted that in regeneration consideration should be given to the variable degree of hardness of the fresh water used. It is not easy to optimize regeneration in this way.

The washing machine according to DE 37 10 511 A1 has a water-softening installation of a similar structure. However, in this, too, the stirring and mixing effect during the regeneration phase is not optimal.

The object of the invention is to design a method of the kind mentioned initially in such a way that the regeneration process is optimized during the regeneration phase in a simple fashion.

This object is achieved according to the invention in that the regeneration valve is opened in the regeneration phase and thus a common water level is set in the storage container, in the saline solution container, in the connecting pipe and the water softener up to the wash or rinse container, which level lies above the upper water level of the saline solution container and the water softener, and in that a through pulse is created in the water supply pipe by opening the intake valve for a short time in the regeneration phase.

In the first part of the regeneration phase the saline solution is led from its container into the water softener and the fresh water stored in the storage container can be pre-measured and adapted optimally to the degree of hardness of the fresh water used. In the second part of the regeneration phase an air-pressure pulse is created in the water supply pipe and this pulse can extend through the water softener up to the wash or rinse container. By means of the air-pressure pulse, a stirring and eddy effect is created so that the saline solution led in reaches the reaction zone of the resin more effectively. The portion of the saline solution standing in the lower region of the water softener is forced upwards by the air-pressure pulse, so that a kind of exchange of the saline solution takes place and said saline solution participates more effectively in regeneration without changing, through the addition of extra fresh water, the concentration of the saline solution which is, of course, adjusted to the degree of hardness of the fresh water used.

Regeneration can easily be further improved by creating, in the regeneration phase, after the regeneration valve has been closed, a plurality of air-pressure pulses in the water-supply pipe by repeatedly opening the intake valve briefly. The air-pressure pulses each time force the portion of the saline solution in the water softener upwards and cause repeated exchange.

The fresh water source can be decoupled quite simply from the water-softening installation by the storage container being connected with the exit of the intake valve via a free air gap and by the in-flow into the storage container being arranged above the outgoing water supply pipe in the upper region of the storage container.

The invention is explained in more detail with the aid of an embodiment, given by way of example and shown in the drawings. These show:

Fig. 1 - the water-softening installation for an automatic washing machine showing its state after the first part of a regeneration phase and

Fig. 2 - the water-softening installation in the second part of the regeneration phase.

First of all, the structure of the water-softening installation of an automatic washing machine according to the invention is to be explained in more detail with the aid of Fig. 1. The intake of fresh water into the water-softening installation is released and stopped via an intake valve 1, controlled by a program control unit 8. For decoupling, i.e. to prevent the flow of water back into the fresh water source, e.g. the water mains, the intake valve 1 is connected, via a free air gap 3, with the storage container 2, which has a capacity e.g. of 300 cm^3 and is connected with the entrance of the water softener

16 via the water supply pipe 4 arranged in the upper region. In the water softener 16 a quantity of active resin 17 is accommodated between a lower membrane 21 and an upper membrane 22. The water supply pipe 4 leads from the water softener 16 on to the wash container 10.

The outlet arranged in the lower region of the storage container 2 leads via a connecting pipe 5 and a regeneration valve 14, controlled by a program control unit 8, to the entrance of a saline solution container 7, which is filled with salt. The exit of the saline solution container 7 leads via a non-return valve 20 to the entrance of the water softener 16, to which the water supply pipe 4 is also joined. The non-return valve 20 is only permeable in the direction from the saline solution container 7 to the water softener 16.

Before the programme starts, the intake valve 1 and the regeneration valve 14 are closed. The storage container 2 is partly filled. If the intake valve 1 is then opened, the storage container 2 is then filled with the regeneration volume of fresh water, i.e. with approximately 300 cm^3. Once this has happened, the fresh water flows via the water supply pipe 4 into the water softener 16 and is softened in it, because the resin binds the hardness components of the fresh water. The soft water then flows from the water softener 16 into the wash container 10, where it is used for rinsing and/or washing processes.

Shortly before the end of the programme, i.e. before the regeneration phase begins, the intake valve 1 and the regeneration valve 14 are closed. The storage container 2 is filled and there is also saline solution in the saline solution container 7. In the water softener 16 the resin has bound the hardness components. In this situation the regeneration valve 14 is opened. From the storage container 2 the pre-measured regeneration volume of fresh water flows into the saline solution container 7 (pressure from geodetic level). The non-return valve 20 opens and saline solution flows into the water softener 16.

The general water level 6 is thereby set, extending uniformly through the connecting pipe 5 between the storage container 2 and the saline solution container 7, through the saline solution container 7, the water supply pipe 4, the water softener 16 and the lower region of the wash container 10. The hardness components are released by the saline solution and the resin 17 is regenerated. The volume 23 of saline solution standing in the water supply pipe 4 does not come into contact with the resin and remains unused. After the first part of the regeneration phase, the regeneration valve 14 is closed and the intake valve 1 is opened briefly. Thus, as shown in Fig. 2, fresh water is discharged briefly into the storage container 2. The volume of water discharged is, however, smaller than the capacity of the storage container 2, so water cannot reach the water softener 16. However, an air-pressure pulse is created, which is transmitted via the air gap 3 and the water supply pipe 4 as far as the wash container 10, as shown by the arrows marked Δp. Due to this air-pressure pulse the water level 6 is altered briefly. The saline solution in the water softener 16 is pressed upwards by the resin in the water softener 16, which also leads to turbulent mixing of the resin. This mixing can be repeated many times, the intake valve 1 being opened briefly each time. In this process the volume of the fresh water led in should not exceed the volume of the storage container 2.

The regeneration process is supported and optimized by these air-pressure pulses created in the second part of the regeneration phase, without diluting the concentration of the saline solution.

Claims

1. Method of regenerating a water-softening installation for an automatic washing machine or dishwasher, which has a wash or rinse container connected to a water container which is filled with active resin and into which fresh water can be led for softening in intake phases via a software-driven intake valve, a storage container and a water supply pipe and into which saline solution for regenerating the resin can be led from a saline solution container by means of a software-driven regeneration valve, a non-return valve being connected after the regeneration valve between the storage container and the saline solution container, said regeneration valve being permeable only in the direction towards the water softener and connected on the exit side with the entrance of the water softener and of a water supply pipe connected electrically to it and taken from the storage container, the outlet of the storage container being arranged above the saline solution container and the water softener in such a way that, when the intake valve is open, fresh water can only be led into the water softener via the water supply pipe when the storage container is full,
characterised in that
in the regeneration phase, the regeneration valve (14) is opened and thus a common water level (6) is set in the storage container (2), in the saline solution container (7), in the connection pipe (5) and the water softener (16) up to the wash or rinse container (10), said level lying above the level of the saline solution container (7) and of the water softener (16), and in that an air-pressure pulse is created in the water supply pipe (4) by opening the intake valve (1) briefly in the regeneration phase.

2. Method according to claim 1,
characterised in that,
in the regeneration phase, after the regeneration valve (14) has been closed, a plurality of air-pressure pulses is created in the water supply pipe (4) by repeatedly opening the intake valve (2) for brief periods.

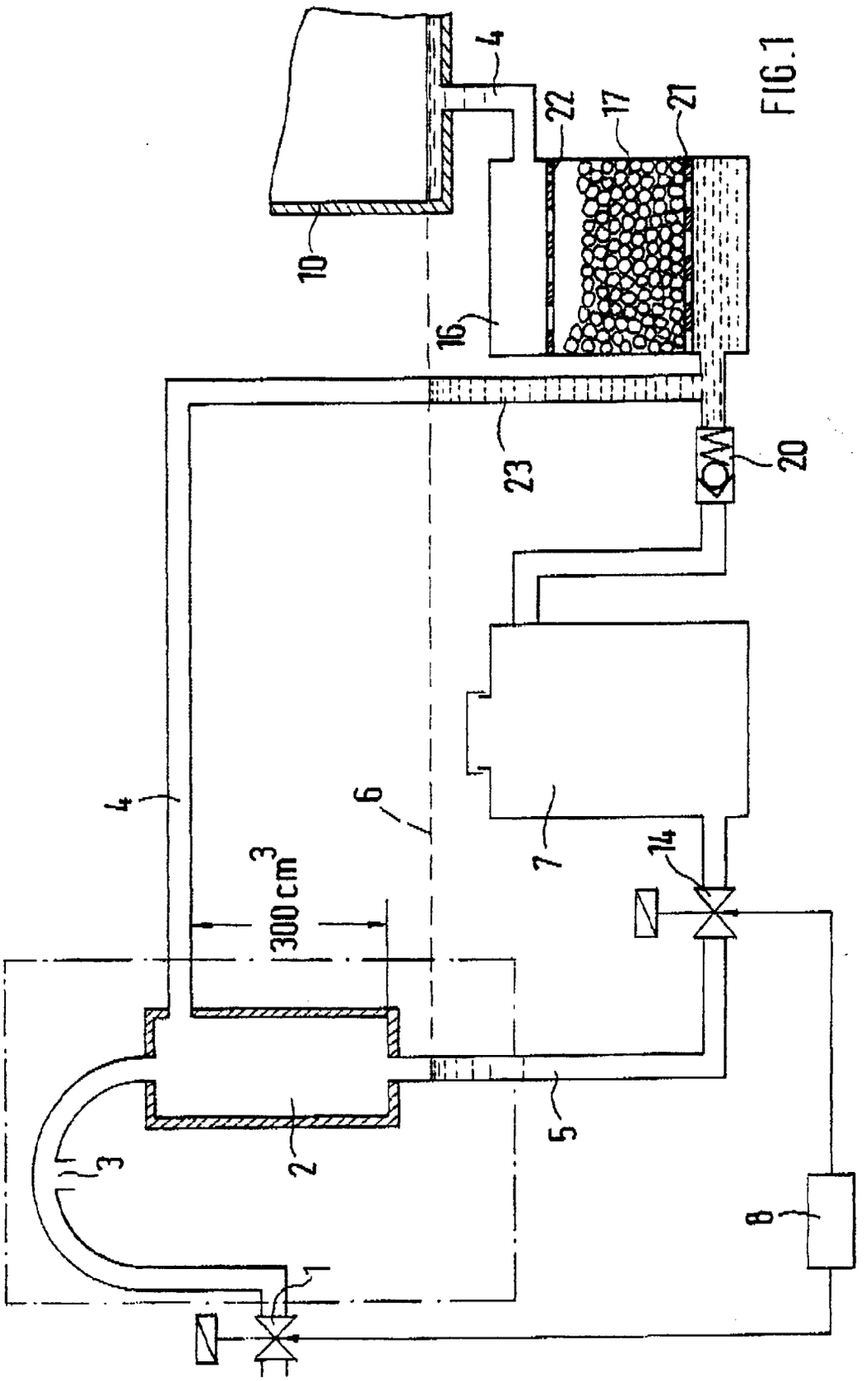

FIG.1

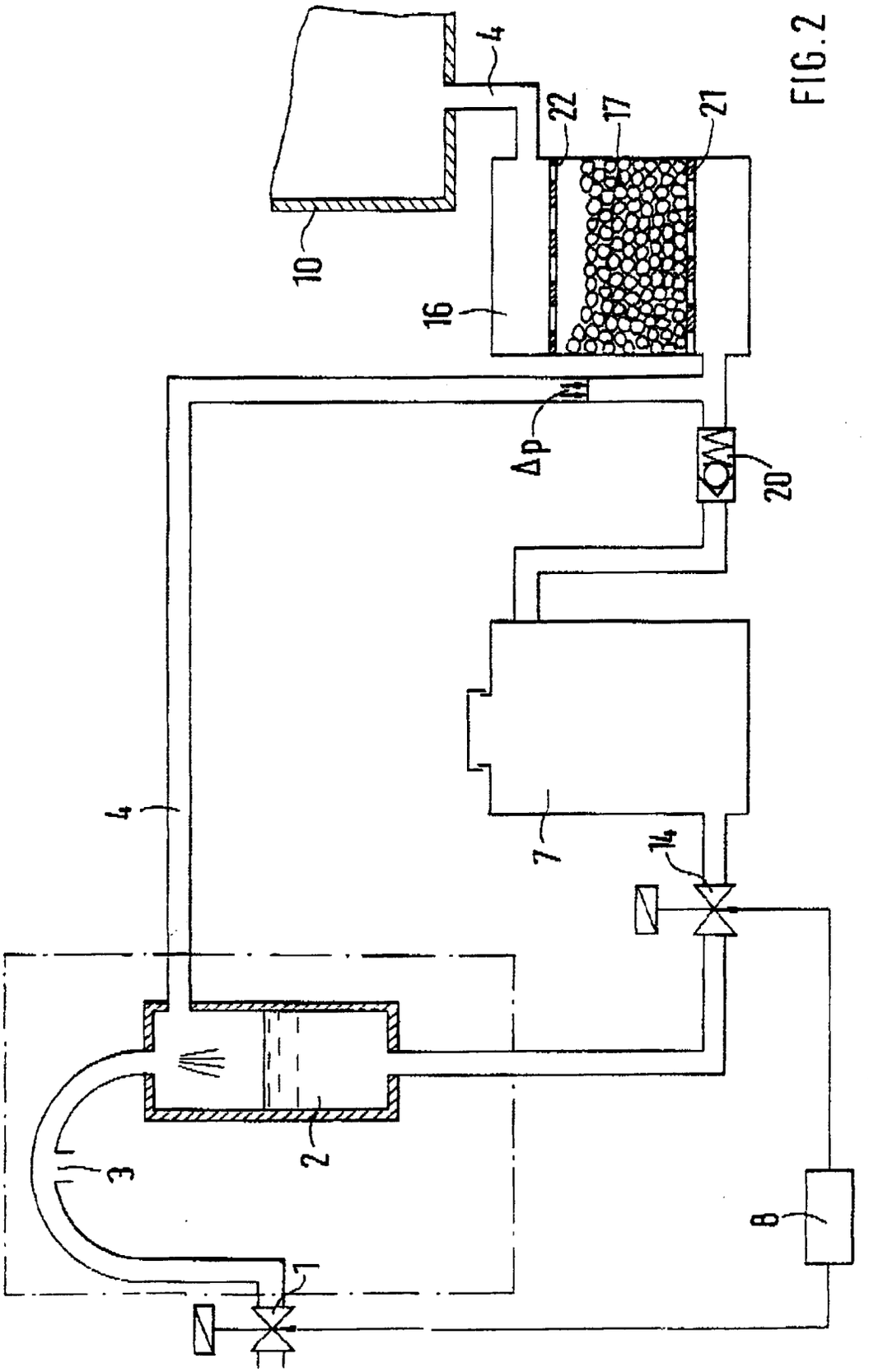

FIG.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 10 9227

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	GB-A-2 067 067 (BOSCH-SIEMENS HAUSGERAETE GMBH) * page 1, line 66 - page 2, line 52; figures *	1	A47L15/42 D06F39/00
A	GB-A-1 138 056 (PHILIPS' GLOEILAMPENFABRIEKEN) * page 2, line 43 - line 59; figures *	1	
A	DE-C-41 31 791 (BOSCH-SIEMENS HAUSGERAETE GMBH) * column 4, line 39 - column 6, line 3; figures *	1	
A	EP-A-0 219 704 (ZANUSSI ELETTRODOMESTICI SPA) * column 2, line 28 - column 4, line 8; figure 1 *	1	
A	FR-A-2 487 186 (LICENTIA PATENT-VERWALTUNGS-GMBH) * page 3, line 8 - page 4; figures *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) A47L D06F
A	FR-A-2 517 951 (INDUSTRIE ZANUSSI SPA) * page 3, line 29 - page 4; figures *	1	
A	EP-A-0 570 872 (AWECO KUNSTSTOFFTECHNIK GERAETEBAU GMBH) * abstract *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	10 September 1996	Vanmol, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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