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

(11) Publication number: **0 146 184**
B1

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **07.06.89**

(51) Int. Cl.[4]: **D 06 F 35/00**

(21) Application number: **84201808.7**

(22) Date of filing: **05.12.84**

(54) **Washing machine with means for producing an oxidising solution of sodium hypochlorite.**

(30) Priority: **16.12.83 IT 2421383**

(43) Date of publication of application:
26.06.85 Bulletin 85/26

(45) Publication of the grant of the patent:
07.06.89 Bulletin 89/23

(84) Designated Contracting States:
DE FR GB SE

(56) References cited:
EP-A-0 031 308
EP-A-0 083 740

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Courier Press, Leamington Spa, England.

Description

This invention relates to an automatic laundry washing machine comprising a washing environment, a container for the salt (NaCl), a water reservoir connectable to a water source, and a cell for the electrochemical production of sodium hypochlorite (NaClO) and hydraulically connected both to the water reservoir by way of the salt container and to the washing environment. Automatic washing machines incorporating means for the in-situ production, in accordance with the wash cycle requirements, of given quantities of an oxidising agent which can be sodium hypochlorite, chlorine and the like, are already known. Thus, for example, European patent application 80810403.8 (publication number 31308) describes a washing machine comprising a reservoir containing a concentrated sodium chloride solution, a dispenser constituted by an electromagnetically controlled piston, and an electrochemical cell to which the dispenser supplies a given quantity of concentrated solution withdrawn from the reservoir. Of the various drawbacks of this machine, the main drawback is the fact that salt deposits form on the dispenser and hinder its movement. A further European patent application (publication number 83740) describes an automatic washing machine which produces gaseous chlorine and comprises a reservoir arranged to contain a metered quantity of water and hydraulically connected by way of a valve and the concentrated sodium chloride solution receptacle to an electrochemical cell in which the anode compartment is separated from the cathode compartment by a diaphragm. The serious drawback of the machine in question is its constructional complexity, partly deriving from the need to make the water absorb the gaseous chlorine evolved in the anode compartment, this being done by using a bubble column. A further drawback is the danger of the gaseous chlorine.

The main object of the present invention is to provide an automatic washing machine comprising a washing environment, a container for the salt (NaCl), a water reservoir connectable to a water source, and a cell for the electrochemical production of sodium hypochlorite (NaOCl) and hydraulically connected both to the water reservoir by way of the salt container and to the washing environment, which with regard to the production of the oxidising agent, i.e. the NaOCl starting from NaCl, is simple, safe and of reliable operation. This and further objects which will be more apparent from the detailed description given hereinafter are attained according to the invention by an automatic washing machine of the type indicated, characterised essentially in that the water reservoir and the electrochemical cell are also hydraulically connected together by way of a further path, and said cell is provided with level determination means to enable it to be filled to a predetermined level, in such a manner that said cell becomes filled with water as far as said level by way of said further path.

The invention will be more apparent from the detailed description of a preferred embodiment given hereinafter by way of non-limiting example and illustrated in the single figure of the accompanying drawing which diagrammatically shows the machine according to the invention.

In the Figure, the reference numeral 1 indicates overall the housing of a laundry washing machine, which in known manner comprises a conduit or pipe 2 for its connection to a cock 3 of the water mains, a wash tub 4, a drum 5 mounted rotatably in the tub and driven by an electric motor (not shown), a discharge pump 6 with its suction side connected to the tub 4 and with its delivery side connected to a discharge pipe 7, a drawer or the like 8 with several compartments 61, 62 to receive the necessary wash product (detergents, witheners and the like), a timer not shown, for controlling the various stages of the wash programmes, and means, shown by way of example as a swivel-mounted nozzle 9 controlled by the timer, which selectively feed water to different points or compartments of the drawer 8 in accordance with the programme.

In the normal manner, the drawer 8 comprises various compartments 61, 62 for the wash products. The timer directs the nozzle 9 towards each of them in accordance with the requirements of the particular programme, in order to supply them with a stream of water which transfers said products through passages 63 into a receptacle 64 which is connected to the wash tub 4 by way of a conduit 65. The washing machine also comprises a container 10 for the salt (NaCl) which is provided with a pipe 11 through which the user loads the salt. The pipe is surrounded at a distance by a sleeve of lesser height 12, the purpose of which is to discharge (see the arrow A') into a surrounding vessel 13 the liquid which, originating from the container 10, necessarily overflows when the salt is loaded. The pipe and sleeve are closed upperly by a plug 14 screwed on in a sealed manner.

The container 10, in which at least part of the salt is dissolved in water, is associated with a container 15 containing an ion exchange resin, the purpose of which is to soften the water used in at least one stage of the wash programmes. The two containers 10, 15 can be connected together by way of a unidirectional solenoid valve EV4 controlled by the timer.

The salt container 10 is hydraulically connected by means of a conduit 16 and a solenoid valve EV3 (also controlled by the timer) to a water reservoir 17, which is positioned in the washing machine at a higher level than the container 10. By means of a dip pipe 18, the container 10 is connected to a rising pipe 19 extending into an electrochemical cell 20.

In known manner, said cell comprises an anode 71 and a cathode 21, which are not separated by a diaphragm, and which can be connected to a direct current electricity supply source by the timer. The cell also comprises a discharge syphon 22 and, in one wall 26, a level determination port 23 of predetermined cross-section which deter-

mines the liquid level in the cell. Finally, the cell 20 comprises a conduit 24 arranged to receive the water which is fed to it by the swivel-mounted nozzle 9 when this latter faces a cup 25 situated at the drawer 8. When primed, the syphon 22 discharges the cell liquid into a collection receptacle 27, which is connected by the pipes 28, 29 and 30 both to the tub 4 and to the suction side of the pump 6.

The water reservoir 17 is disposed to the side of the collection receptacle 27, and upperly comprises a side overflow 31 which enables part of the excess water overflowing from said reservoir to be discharged into the cell 20. The remainder of the overflowing water falls from the sides of the bent overflow plate and into the underlying collection receptacle 27, and from here flows into the said pipe 28.

The water reservoir 17 is fed by the pipe 32, which is connected to the cock 3 by way of the solenoid valve EV2. The pipe 32 opens above the level M, which the water can reach in the reservoir 17 and is at a higher level than the lever determination port 23 of the cell 20.

The resin container 15 is connected to the cock 3 by way of the pipe 33, the solenoid valve EV5 and a conventional pipe interruptor 34 which, in the limit, can be represented by a hole provided in the pipe wall. The water from the solenoid valve EV5 is collected by the vessel 35 and is conveyed by the pipe 36 to the collection receptacle 27. The resin container 15 is also connected to the nozzle 9 by way of the pipes 37 and 73 and the pipe interruptor 38. The water leaving the interruptor 38 flows into the vessel 39 and from here to the pipe 29 through the connection 70.

The nozzle 9 is connected to the cock 3 by way of a solenoid valve EV1 and a pipe interruptor 40. The water leaving this latter discharges into the collection receptacle 27 by way of the vessel 41 and the pipe 42.

In addition, in one of its positions, the nozzle 9 can supply water to a vessel 43 connected to the pipe 30 by way of the connection 72.

The operation is as follows. At the commencement of the wash programme, the container 10 contains brine (a saturated solution of NaCl in water) and undissolved salt, which have previously been loaded by the user. The timer causes the valve EV2 to open so that mains water enters the reservoir 17. When this water reaches the level M, it discharges through the side overflow 31 into the underlying cell 20. In this latter, the water rises until it attains the level A-A set by the port 23, but without priming the syphon 22. The valve EV2 is then closed when the water is at the level M in the reservoir 17 and at the level A-A in the cell 20.

At this point the timer opens the valve EV3. Because of the difference in levels, the water descends from the reservoir to the container 10 along the pipe 16. Consequently, the pre-existing brine (with undissolved salt) is forced to rise along the pipes 18, 19 and into the cell 20, the top of the pipe 19 being slightly higher than the lower edge of the level determination port 23. In this manner the brine mixes with the water already present in the cell 20, and the excess liquid discharges through the level determination port 23. This liquid flows along the pipes 28, 29, 30 and into the zone below the wash tub 4, but remains inside the washing machine because the pump 6 is not in operation. Transfer of the brine to the cell 20 automatically ceases when the water level in the reservoir 17 reaches a level B-B at which hydrostatic equilibrium is established between the liquid column (water) in the reservoir 17 and the liquid column (brine) in the cell 20.

As shown in the figure, the level B-B is lower than the level M but higher than the level A-A, because of the difference in density between brine and water. The aforegoing indicates a considerable advantage of the present invention over the state of the art, in that the dispensing of the NaCl is effected in a manner which is extremely simple, without moving members, but is precise and reliable. Having reached this point, the timer closes the valve EV3 and makes the direct current circuit feeding the electrodes 71 and 21, so that electrolysis of the brine in the cell 20 commences.

At this point, the ion exchange resins located in the container 15 undergo their washing stage. The timer controls the solenoid valve EV5 so that mains water passes along the pipe 33 and into the container 15. This water pushes the brine (which, as will be more apparent hereinafter, is present from the end of the preceding laundry wash programme together with a large quantity of calcium ions) along the pipes 73, 37 until it reaches the nozzle 9. This latter is positioned above the vessel 43 so that the said brine becomes discharged from the machine through the pipes 73, 37, 7 the pump 6 being in operation. On termination of this brine discharge, the timer stops the pump 6, directs the nozzle towards one of the compartments 61, 62 containing the wash agents and keeps the valve EV5 open. Consequently, the mains water is softened in the container 15, is fed to the nozzle 9 through the pipes 73 and 37, and is finally mixed with detergent in order to flow through the pipe 65 to the wash tub 4, where it is used in the manner well known to the experts of the art.

During all this time, the brine is electrolysed in the cell 20 to form NaClO. During the stage scheduled by the wash programme, for example during the laundry rinsing, the timer breaks the circuit of the electrodes 21 and 71, displaces the nozzle 9 in order to direct it (as shown in the figure) towards the cup 25, and simultaneously opens the valve EV1. Consequently mains water reaches the cell 20 through the pipe 24. As the throughput of the valve EV1 is greater than the throughput which can be discharged through the port 23, the level of the liquid contained in the cell 20 rises until it climbs the syphon 22. If the level increases, the water overflows from the upper edge 60 of the wall 26 and into the receptacle 27, and from here passes through the pipes 28 and 29 and into the tub 4 (as the pump 6 is at rest), said

tub partly being at a level less than the cell 20. After a certain time the timer closes the valve EV1 because of which, by virtue of the syphon 22 and without the need for using bottom solenoid valves, the entire contents of the cell 20 (i.e. NaClO in aqueous solution) are discharged into the wash tub. The laundry bleaching stage is then effected, as scheduled by the wash programme.

The last stage of the wash programme provides for the regeneration of the ion exchange resins. The timer starts the pump 6 and opens the valves EV3, EV4. The water contained in the reservoir 17, which had reached the level B-B, flows through the pipe 16 and into the salt container 10. The brine contained in this latter is then transferred through the valve EV4 and into the resin container 15. The water present in the container 15 is thus forced to rise under a modest thrust pressure through the pipe 73 until it reaches the vessel 39. From here the water falls through the pipes 70, 29, 30 to the pump 6, which expels it from the machine through the discharge pipe 7.

When the wash programme finishes, the machine is in the same state as the commencement of the operation heretofore described, i.e. the valves EV1 etc. are all closed, the pump 6 is at rest, the electrode circuit 71, 21 is broken, the cell 20 and the reservoir 17 are empty, the container 10 contains brine with undissolved NaCl and the container 15 contains the resins together with brine and a large quantity of calcium ions originating from the softening of the mains water.

The secondary advantages of the present invention include the fact that the syphon 22 effectively replaces a discharge valve at lesser cost, and that the rising pipe 19 is provided in order to prevent excessive dilution of the brine contained in the container 10. Although only one embodiment of the invention has been described, it will be simple for an expert of the art in possession of the inventive idea to make numerous modifications, which however must all lie within the scope of the invention itself.

Claims

1. An automatic washing machine comprising a washing environment, a container (10) for sodium chloride, a water reservoir (17) connectable to a water source, and a cell (20) for the electrochemical production of sodium hypochlorite and hydraulically connected both to the water reservoir by way of the salt container (10) and to the washing environment, characterized in that the water reservoir (17) and the electrochemical cell (20) are also hydraulically connected together by way of a further path (31), and said cell (20) is provided with level determination means (23) to enable it to be filled to a predetermined level (A-A), in such a manner that said cell (20) can be filled with water as far as said level (A-A) by way of said further path (31).

2. A machine as claimed in Claim 1, characterized in that the level determination means comprise at least one port (23) present in a wall(26) of the cell (20).

3. A machine as claimed in Claim 1, characterized in that said further path (31) begins at the water reservoir (17), at a height (M) which is greater than the height (A-A) of the level determination means (23) of the cell (20).

4. A machine as claimed in Claim 2, characterized in that a syphon (22) is provided for discharging the cell (20).

5. A machine as claimed in Claim 3, characterized in that the water throughput through said further path (31) does not enable the height of the water in the cell (20) to each a level such as to prime the syphon (22).

6. A machine as claimed in Claims 1 and 2, characterized in that said further path (31) comprises a side over flow (31) which extends in a cantilever manner on to the cell (20).

7. A machine as claimed in Claim 1, characterized in that the cell (20) discharges into a collection receptacle (27) which is hydraulically connected to the pump (6) and to the washing environment (4).

8. A machine as claimed in Claim 1, characterized in that the sodium chloride container (10) is connected to the cell (20) by a rising conduit (19) which opens at a height not lower than said level (A—A).

Patentansprüche

1. Automatische Waschmaschine mit einem Bottich, einem Behälter (10) für Natriumchlorid, einem mit einer Wasserquelle verbindbaren Wasserbehälter und mit einer Zelle (20) zur elektrochemischen Erzeugung von Natriumhypochlorit, wobei diese Zelle mit dem Wasserbehälter verbunden ist, und zwar mittels des Salzbehälters (10), sowie mit dem Bottich, dadurch gekennzeichnet dass der Wasserbehälter (17) und die elektrochemische Zelle (20) über einen anderen Weg (31) ebenfalls hydraulisch miteinander verbunden sind und dass die genannte Zelle (20) mit Pegelbestimmungsmitteln (23) versehen ist, durch die es möglich ist, dass sie bis zu einem vorbestimmten Pegel (A-A) derart gefüllt wird, dass diese Zelle (20) bis an den genannten Pegel (A-A) über den genannten weiteren Weg (31) mit Wasser gefüllt werden kann.

2. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass die Pegelbestimmungsmittel wenigstens eine Öffnung (23) in einer Wand (26) der Zelle (20) aufweisen.

3. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass der genannte weitere Weg (31) beim Wasserbehälter (17) anfängt, und zwar in einer Höhe (M), die grösser ist als die Höhe (A-A) der Pegelbestimmungsmittel (23) der Zelle (20).

4. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass ein Heber (22) zum Entleeren der Zelle (20) vorgesehen ist.

5. Maschine nach Anspruch 3, dadurch gekennzeichnet, dass die Wasserdurchlaufmenge durch den genannten weiteren Weg (31) es nicht ermöglicht, dass die Höhe des Wassers in der Zelle (20) einen derartigen Pegel erreicht, dass der Heber (22) wirksam wird.

6. Maschine nach Anspruch 1 und 2, dadurch gekennzeichnet dass der genannte weitere Weg (31) einen Seitenüberlauf (31) aufweist, der sich wie ein Ausleger zu der Zelle (20) erstreckt.

7. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass die Zelle (20) sich in einem mit der Pumpe (6) und dem Bottich (4) hydraulisch verbundenen Sammelbehälter (27) entleert.

8. Maschine nach Anspruch 1, dadurch gekennzeichnet, dass der Natriumchloridbehälter (10) durch ein ansteigendes Rohr (19) mit der Zelle (20) verbunden ist, wobei dieses Rohr auf einer Höhe offen ist, die niedriger ist als der genannte Pegel (A-A).

Revendications

1. Machine automatique à laver le linge, comportant une enceinte de lavage un récipient (10) à chlorure de sodium un réservoir d'eau, (17) pouvant être relié à une source d'eau' et une cellule (20) servant à produire par voie électrochimique de l'hypochlorite de sodium et qui est reliée hydrauliquement au réservoir d'eau, par l'intermédiaire du récipient à sel (10), aussi bien qu'à l'enceinte de lavage, caractérisée en ce que le réservoir d'eau (17) et la cellule électrochimique (20) sont également reliés hydrauliquement entre eux par une autre voie (31), et en ce que ladite cellule (20) est munie de moyens de détermination de niveau (23) pour permettre de la remplir jusqu'à un niveau prédéterminé (A-A), de telle manière que cette cellule (20) puisse être remplie d'eau jusqu'audit niveau (A-A) par ladite autre voie (31).

2. Machine selon la revendication 1, caractérisée en ce que les moyens de détermination de niveau comportent au moins un orifice (23) pratiqué dans une paroi (26) de la cellule (20).

3. Machine selon la revendication 1, caractérisée en ce que ladite autre voie (31) commence à l'endroit du réservoir d'eau 17, à un niveau (M) supérieur au niveau (A-A) des moyens de détermination de niveau (23) de la cellule (20).

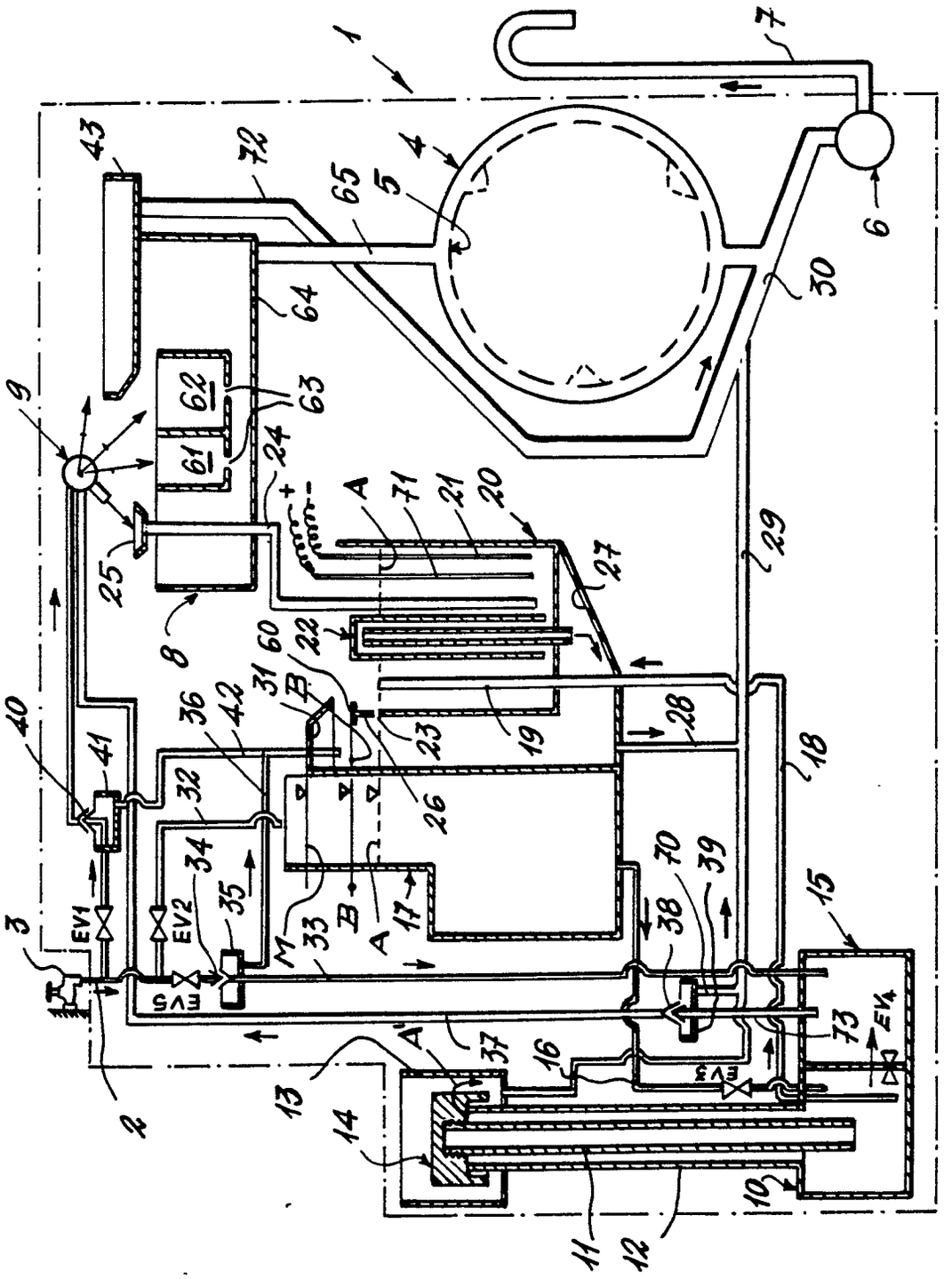
4. Machine selon la revendication 2, caractérisée en ce qu'il est prévu un siphon (22) pour vider la cellule (20).

5. Machine selon la revendication 3, caractérisée en ce que le débit d'eau par ladite autre voie (31) ne permet pas au niveau de l'eau contenue dans la cellule (20) d'atteindre un niveau tel qu'elle amorce le siphon (22).

6. Machine selon les revendications 1 et 2, caractérisée en ce que ladite autre voie (31) comporte un trop-plein latéral (31) s'étendant en porte-à-faux jusqu'au-dessus de la cellule (20).

7. Machine selon la revendication 1, caractérisée en ce que la cellule (20) se déverse dans un bac collecteur (27) relié hydrauliquement à la pompe (6) et à l'enceinte de lavage (4).

8. Machine selon la revendication 1, caractérisée en ce que le récipient à chlorure de sodium (10) est relié à la cellule (20) par un conduit montant (19) débouchant à un niveau non inférieur audit niveau (A-A).


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