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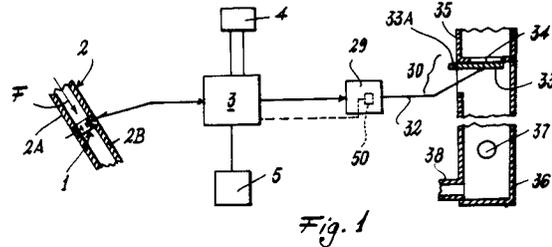
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54 **Method and device for automatically optimising the use of detergent in a washing machine, washing-drying machine, dishwasher or the like, by measuring the water hardness.**

57 A method for automatically optimizing the use of detergent in a washing machine, washing-drying machine, dishwasher or the like comprising a usual detergent container or drawer (35), said method consisting of monitoring, at least at the commencement of a machine wash cycle, the conductivity of the water entering the machine and hence its hardness, and on the basis of this feeding a suitable quantity of detergent into the wash tub or environment, this quantity being proportional at least to the measured water hardness. A device for implementing the afore-said method comprises water conductivity measurement means (1) connected to means (3) for evaluating the measured conductivity value and which control selector means (30) for feeding a suitable quantity of detergent into the wash tub or environment.



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This invention relates to a method for automatically optimizing the use of detergent in a washing machine, washing-drying machine, dishwasher or the like, by measuring the hardness of the wash water.

The invention also relates to a device for implementing the said method.

Hardness is known to be an intrinsic characteristic of water and is due mainly to the presence of magnesium and calcium salts. In general, using a given detergent in said machine, the harder the water (ie its richness in said salts) the lesser the washing efficiency of the detergent.

An object of the invention is to provide a method for automatically optimizing the use of detergent on the basis of the particular hardness of the wash water.

A further object is to provide a method of the said type which is simple to perform and achieves a considerable reduction in the use of detergent by feeding the correct detergent quantity without wastage.

A further object is to provide a method which achieves a substantial cost saving for the machine user.

A further object is to provide a device for implementing the aforesaid method which is of simple construction, low cost and reliable with time.

These and further objects which will be apparent to the expert of the art are attained by a method in accordance with the characterising part of the relative independent claim.

The aforesaid objects are further attained by a device in accordance with the corresponding independent claim.

The present invention will be apparent from the accompanying drawing, which is provided by way of non-limiting example and in which:

Figure 1 is a block diagram of the device of the present invention;

Figure 2 is a circuit scheme of part of the device of the invention, this scheme comprising usual electrical and/or electronic components which are of clear understanding to the expert of the art and are hence not described in detail; and

Figure 3 is a front view of part of the scheme of Figure 2 when implemented.

With reference to said figures, the device of the invention comprises a conductivity sensor 1 positioned in a pipe 2 through which water enters the tub for example of a washing machine (not shown). The sensor is associated with a unit 3 for evaluating the conductivity measured by the sensor 1. For this purpose, the evaluation unit 3 cooperates with a memory 4 containing conductivity reference values. The unit 3, which is connected to the usual washing machine timer 5, controls the feed of detergent into the said tub in a quantity

proportional to the measured conductivity value.

More specifically, the sensor 1 is a conductivity cell and measures the conductivity or impedance between two flat plates 10, 11 arranged parallel to each other and spaced apart within a support 12 positioned along the water path to the washing machine tub (represented by the arrow F in Figure 1). This support comprises for example an annular body 13 provided with lateral lugs 14 for its fixing to any known fixed part of the washing machine. Internally, the body 13 comprises an annular seal 15 and by means of arms 16 supports said plates 10, 11. The body 13 is positioned between two portions 2A and 2B of the pipe 2 and is traversed by the water entering the machine.

The plates 10, 11 are connected to an electrical discriminator circuit 20 for the conductivity data obtained by the sensor 1.

This discriminator circuit (shown in Figure 2) comprises a circuit block 21 operating as an alternating oscillator and hence generating a sinusoidal signal preferably of frequency between 900 Hz and 1200 Hz to prevent the water undergoing electrolysis on passing between the plates 10 and 11. The block 21 is connected to a circuit block 23 acting as a high impedance differential amplifier. Before reaching the block 23, the output signal from the block 21 is fed to the plates 10 and 11 arranged in "bridge" configuration together with two resistors 24 and 25. The output from the amplifier 23 is fed to a rectifier 26 and then to an integrator 27 so that at the output of the circuit 20 there is a direct current signal which is fed to a control and operating unit 28 which acts on an actuator 29 for moving a metering member 30 for the detergent to be fed to the washing machine tub. The circuit 20 and the unit 28 form the said evaluation unit 3.

The actuator 29 is for example an electric stepping motor acting on an arm 32 connected to a movable flap 33 (hinged at 33A to a fixed part of the machine) which closes an aperture 34 in a detergent container 35 connected to a vessel 36 to which water flows from a pipe 37 and from which the detergent can pass into the washing machine tub via a pipe 38. The arm 32 and flap 33 define said metering member 30.

The method of the invention will now be described in relation to the use of the device shown in the aforesaid figures.

It will be assumed that a wash cycle is commenced in the washing machine. On initial entry of water into the tub, the sensor 1 positioned in the feed pipe 2 measures the conductivity of the water by means of a signal generated within the circuit 20 by the "bridge" defined by the plates 10 and 11 and the resistors 24 and 25. In this respect, when the hardness of the water varies, the signal emitted

by the plates 10 and 11 varies, as consequently does that emitted by said bridge.

The circuit 20 hence generates a continuous signal as heretofore described,, and this is fed to the unit 28. This latter is for example a microprocessor circuit or a logic gate comparison circuit. It compares the signal received from the circuit 20 with predetermined values present in the memory 4 corresponding to particular quantities of detergent to be fed to the tub.

Following this comparison and on the basis of it, and following an enabling signal from the timer 5 (fed when the wash program requires detergent to be fed into the tub), the unit 28 activates the actuator (or stepping motor) 29 which moves the flap 33 so that it uncovers the aperture 34 to cause a predetermined quantity of detergent to be delivered. Sensor means (such as an encoder on the usual output shaft of the motor 29) are provided to determine the movement of the arm 32 and of the flap 33. These sensors are shown generically and are indicated by 50, they being connected to the unit 3. On the basis of the signals originating from the sensors 50, the evaluation unit 3 is able to indirectly know the quantity of detergent which has passed from the vessel 35 to the vessel 36.

Alternatively the actuator 29 can be a positive displacement pump which acts directly on the detergent contained in the vessel 35.

Other actuators are possible within the scope of the present document.

Returning to the method of the invention, the control and operating unit 28 therefore enables detergent to be fed from the container 35 to the vessel 36 in a quantity proportional to the measured water conductivity (or hardness). The harder the water the greater the detergent quantity fed to the vessel 36, from which it is fed to the washing machine tub in known manner.

A particular embodiment of the invention has been described. Other embodiments falling within the scope of the present document are however possible.

### Claims

1. A method for automatically optimizing the use of detergent in a washing machine, washing-drying machine, dishwasher or the like comprising a usual pipe (2) for feeding water into the wash tub or environment, a usual detergent container or drawer (35), a usual member (36) for dispensing this latter into said tub and a usual programmer or timer (5) controlling the various operational stages of the machine, said method being characterised by consisting of monitoring, at least at the commencement of a machine wash cycle, the conductivity of the

water entering the machine and hence its hardness, and on the basis of this feeding a suitable quantity of detergent into the wash tub or environment, this quantity being proportional at least to the measured water hardness.

2. A method as claimed in claim 1, characterised in that the measured conductivity is compared with predetermined conductivity values, these corresponding to particular quantities of detergent to be fed into the wash tub or environment.

3. A method as claimed in claim 1, characterised in that the detergent is fed into the tub following an enabling signal from the machine programmer or timer (5).

4. A method as claimed in claim 1, characterized in that the water conductivity is measured by a variation in an electrical characteristic of conductivity sensor means (1) which are exposed to the water before it enters the wash tub or environment.

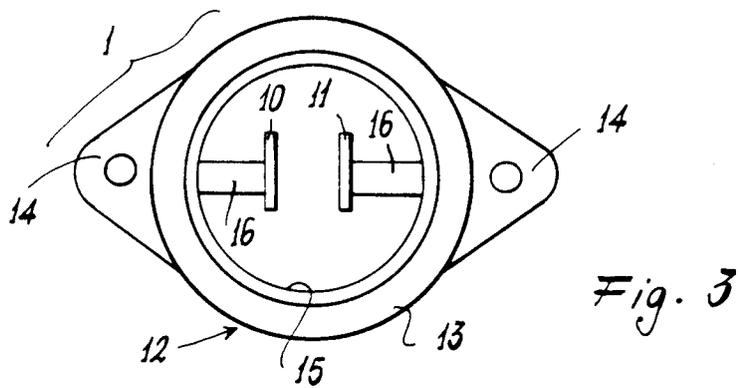
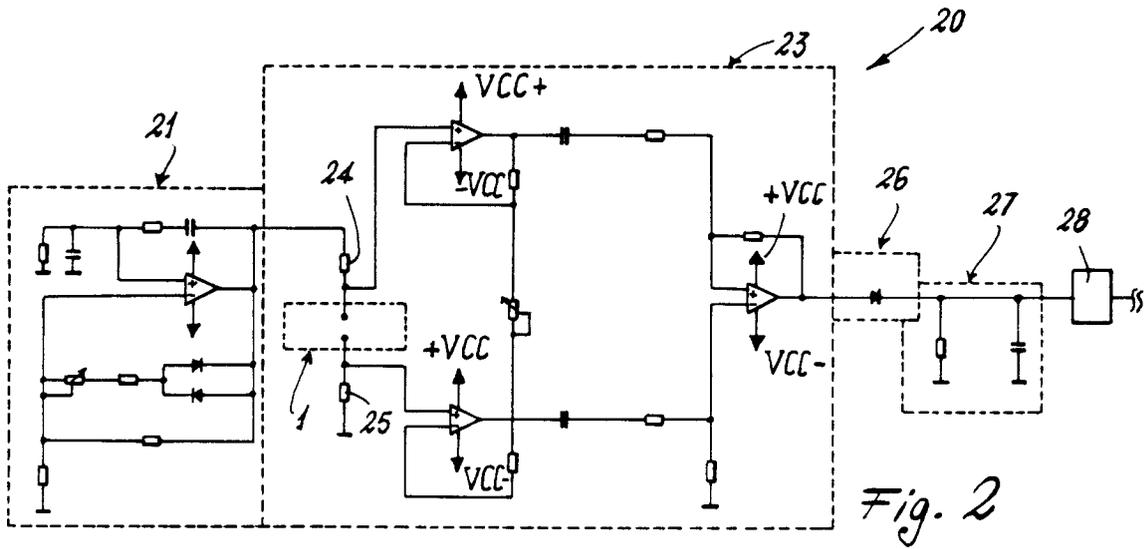
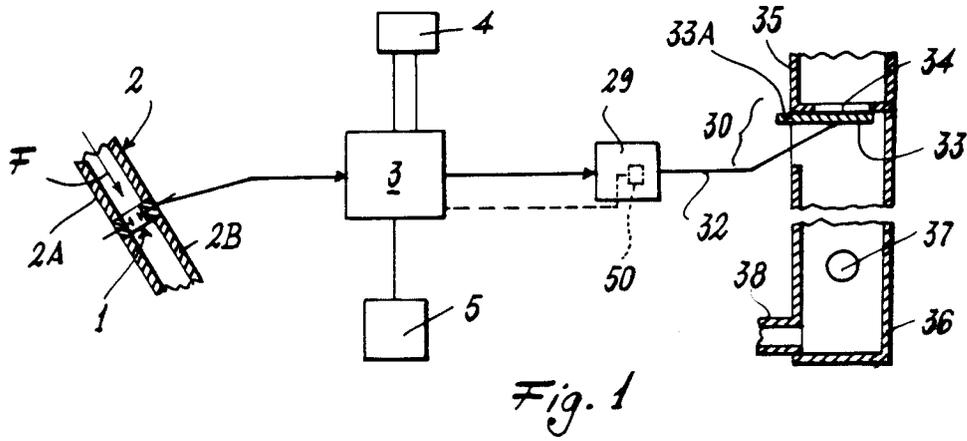
5. A method as claimed in claim 1, characterised in that the detergent is fed into the tub by feeding a quantity of said detergent proportional to the measured conductivity from the container or drawer (35) to the dispenser member (36) and from this latter into said tub.

6. A device for implementing the method of claim 1, characterised by comprising means (1) for measuring the conductivity of the water entering the wash tub or environment, said means being connected to means (3) for evaluating the measured conductivity value which, on the basis of this latter value, control selector means (30) for feeding a suitable quantity of detergent into the wash tub or environment.

7. A device as claimed in claim 6, characterised in that the measurement means are a conductivity sensor (1) of resistive type such as a conductivity cell.

8. A device as claimed in claim 7, characterised in that the measurement means (1) are supported by a member (12) associated with the pipe (2) by which the water is fed into the tub, said member comprising an annular body (13) in which supports (16) for the measurement means are provided, said body being traversed by the water entering the wash tub or environment.

9. A device as claimed in claim 6, characterised in that the evaluation means (3) comprise a control unit (28), preferably a microprocessor circuit, connected to the measurement means (1) via a electrical circuit (20) and cooperating with a memory unit (4) containing predefined conductivity values and corresponding quantities of detergent to be fed to the wash tub or environment. 5
10. A device as claimed in claim 9, characterised in that the electrical circuit (20) comprises a circuit block (21) generating an alternating oscillating signal and connected to a circuit block (23) acting as a differential amplifier with a high input impedance, the signal emitted by this latter being handled by a circuit block (26) acting as a rectifier to which there is connected a circuit block (27) acting as an integrator, this latter being connected to the control unit (28). 10 15 20
11. A device as claimed in claims 7 and 10, characterised in that the conductivity sensor (1) comprises flat elements (10, 11) arranged as a "bridge" with resistive elements (24, 25) in the electrical circuit (20) downstream of the circuit block (21) generating the oscillating signal and before the block (23) acting as the amplifier. 25 30
12. A device as claimed in claim 10, characterized in that the oscillating signal generation block (23) generates this signal at a frequency of preferably between 900 Hz and 1200 Hz. 35
13. A device as claimed in claim 6, characterized in that the evaluation means (3) are connected to the machine programmer or timer (15). 40
14. A device as claimed in claim 6, characterised in that the selector means are at least one member (30) acting on the detergent container or drawer such as to cause the detergent to leave said drawer in a metered quantity, said member being controlled by actuator means (29) the operation of which is controlled by the evaluation means (3). 45
15. A device as claimed in claim 6, characterised by comprising enabling means (50) operationally connected to the selector means (30) and connected to the evaluation means (3), to enable these latter to ascertain when the metering of the detergent has been effected following operation of the selector means (30). 50 55





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EUROPEAN SEARCH REPORT

Application Number  
EP 93 11 0763

| 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) |
| X   | US-A-3 223 108 (WHIRLPOOL CORPORATION)  | 1-8,<br>13-15   | D06F39/00<br>D06F39/02                       |
| A   | * column 2, line 54 - line 60 *<br>* column 4, line 40 - line 56; figures 1,4-6 * | 9   |  |
| A   | ---<br>US-A-3 645 669 (G. RAUSCH)<br>* column 5, line 18 - line 40; figure 5 *    | 1-9,<br>13-15   |  |
| A   | ---<br>DD-A-232 518 (VEB WASCHGERÄTEWERK SCHWARZENBERG)<br>* abstract; figure *   | 1-3,5,<br>13,14   |  |
| A   | ---<br>EP-A-0 506 137 (HITACHI LTD.)<br>* abstract; figures 3,7,8 *               | 10-12   |  |
|   |   |   | TECHNICAL FIELDS SEARCHED (Int.Cl.6)         |
|   |   |   | D06F<br>A47L                                 |
| The present search report has been drawn up for all claims  |   |   |  |
| Place of search<br>THE HAGUE  |   | Date of completion of the search<br>7 December 1993   | Examiner<br>Courier, G                       |
| CATEGORY OF CITED DOCUMENTS   |   | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |  |
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