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(54) **Washing machine with control of the detergent use and control method thereof**

Waschmaschine mit Waschmittelverbrauchssteuerung und Steuerungsverfahren

Machine à laver avec commande de l'utilisation de détergent et procédé de commande

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EP 0 666 358 B1

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Description

[0001] The present invention relates to a control method of a washing machine and a washing machine, in particular a laundry washing machine or a domestic dish-washing machine, according to the preamble of the annexed claims 1 and 7. It is known that domestic laundry-washing machines are equipped with dispensing devices of the washing agents, such as detergents, whiteners, softeners, etc. Such dispensing devices are usually made up of a drawer-like container that is able to be charged with the washing agents, and to be successively passed over by a flow of conveying water. The drawer is usually divided in a series of compartments, each of which is charged with a dosage of detergents or additive to be utilised during the various phases of the washing program; each of such compartments is obviously placed in communication, whilst in the working position, with suitable entrance and water drainage pipes.

[0002] In function of the type of laundry to be washed, the user selects a washing program and provides for introducing to the various compartments of the dispenser the recommended quantity of said washing agent; at an appropriate moment, upon a command of the control system (of the electro-mechanical or electronic type) of the machine, the water to be introduced to the washing chamber of the machine is made to pass through each of the various compartments, so as to carry the relative washing agents in the chamber; i.e. based on the selected program, and according to the washing phases reached, the control system provides for withdrawing at appropriate times the various washing agents from the relative compartments.

[0003] It is also known that the washing programs of laundry washing machines, managed by the programmer, can provide for different phases, during which washing agents are introduced to the tub; for instance a washing program can, from among other phases, provide for:

- a pre-wash phase, with the introduction of detergents to the tub;
- an actual washing phase, with the introduction of a greater quantity of detergents to the tub compared to the pre-wash;
- an after-wash phase, with the introduction to the tub of a softener, or other additive.

[0004] Modern laundry washing machines therefore have numerous washing programmes incorporated that can be selected, comprising one or more of the aforementioned phases. The great number of such programs may at times cause the user to make mistakes; for example the case wherein the user introduces, in the various compartments of the dispenser, detergents for the pre-wash, detergents for the wash itself and a softener, and then goes on to erroneously select a program that

does not provide for a pre-wash and/or after-wash with softener; also imagine the case wherein the user of a laundry washing machine, or of a dish-washer, starts a program without having introduced to the dispenser device the necessary washing agents: the consequences of such errors are in both cases easily imaginable.

[0005] For reducing said risks, washing machine have been realized comprising systems for the automatic dosage and addition of the detergent, during a washing program. See for instance US 3,645,669, US 3,223,108 or FR-A-2.455.648.

[0006] In document US-A-3 649 669 the features of the preambles of claims 1 and 7 are disclosed.

[0007] It is also known that, generally speaking, the use of several washing phases, in particular the pre-wash, in modern laundry washing machines is increasingly becoming much less important than it was: it is however clear that such phases should be provided for with laundry washing machines, so as to satisfy all eventual requirements of the user.

[0008] The present invention is based on the acknowledgement of the aforementioned facts and its purpose is that of indicating a washing machine that, with simple and economic means, both being of improved functioning and reliability; further purpose of the present invention is that of indicating a washing machine in which possible operational errors of the user, in relation to the use of washing agents, can be reduced and/or corrected.

[0009] For reaching such purposes, the present invention has as its subject a washing machine and a control method having the characterizing feature of the annexed claims.

[0010] Further characteristics and advantages of the present invention shall become clear from the following description and annexed drawings, provided purely as an explanatory and nonlimiting example, wherein:

- figure 1 schematically represents a device for measuring the resistivity of the washing liquid in a washing machine according to the invention;
- figure 2 represents in a simplified manner the relation existing between the resistivity of the washing liquid (detected with the device of figure 1) and the concentration of detergents in such water, expressed as grams per litre;
- figure 3 partially represents a device for dispensing the washing agents;
- figure 4 schematically represents a possible embodiment of the control system of a washing machine according to the present invention;
- figure 5 represents a logic flow diagram of the control system of the machine of figure 4.

[0011] The washing machine according to the present invention has a microcontroller type command unit, that works with fuzzy logic, and has an adequate knowledge base, obtained through the experience of technicians and by way of experimental research, and coded in the

permanent memory associated to the microcontroller of the control unit; the control unit then has the use of, by way of appropriate measuring means, information relative to physical characteristics of the washing liquid.

[0012] In particular, in the case described, the machine according to the invention is equipped with an appropriate measuring device of the resistivity of the washing water: in figure 1 one of the possible embodiments of such device is illustrated.

[0013] Said device for measuring the resistivity of the washing water within a laundry washing machine has two electrodes, indicated in figure 1 with the letters A and B. The electrode A is constituted by an electrically conductive element, arranged in direct contact with the washing liquid, that in the case of figure 1 coincides with the same metallic body V of the machine (tub-basket complex), but could also be isolated from the same by way of an appropriate rubber seal. The electrode B is constituted by an electrically conductive element arranged in direct contact with the washing liquid and isolated with regards electrode A.

[0014] As can be noted from figure 1, connecting the electrode A to the positive pole of a continuous voltage generator E (example $E=5V$) and connecting the electrode B to earth (negative pole of the same voltage generator E) by way of a capacitor C of an appropriate capacity (example $C=1$ microfarad), and in view of the fact that the washing liquid is surely conductive, a flow of current from A and B is obtained, proportional to the resistivity of the water.

[0015] Such flow of current goes on to supply the transient charge of the capacitor C and stops when such transient has finished, i.e. when a voltage being equal to the value of E is present at the ends of the capacitor C. The duration of the charge transient depends upon the value of the capacitor C and on the value of resistivity of the means (washing water) through which the charge current flows.

[0016] Once an appropriate value of the capacitor C has been established (for instance $C=1$ microfarad), it is possible to obtain information on the resistivity of the washing water by measuring the duration of the charge time of the actual capacitor C. As is illustrated in figure 1, the measuring of the charge time is carried out by a common commercial microcontroller MP (architected to 4 or 8 bits) able to measure the time with a good resolution (for instance with a resolution of 1 microsecond).

[0017] A digital input of the microcontroller MP, named INP in figure 1, is connected to the ends of the capacitor C, while its digital output, named OUT, is used for piloting a transistor Q, used as a switch, the collector of which is in turn connected to the ends of the capacitor C.

[0018] The measure of the charge time of the capacitor C is carried out by the following operations of the microcontroller MP:

- rapid discharge of the capacitor C, obtained by applying a brief impulse (for instance being of the du-

ration of 1 millisecond) based on the transistor Q through the output OUT;

- initiating the time metering the instant in which, upon termination of the discharge impulse of the capacitor, the transistor Q returns to the cut-off state, allowing the beginning of the charge of the capacitor;
- interruption of the time metering the instant in which the voltage at the ends of the capacitor reaches the step threshold of the digital input INP, the value of which being typically equal to half of the supply voltage of the microcontroller MP (i.e. $E/2=2.5V$);
- the value reached by the time meter present within the MP, at the instant of the interruption of the metering, constitutes the result of the measure and is in direct relation with the actual resistivity of the washing liquid.

[0019] With this aim, as mentioned, the microcontroller MP is conveniently programmed according to the fuzzy logic technique, with an adequate knowledge base, coded in the permanent memory (ROM) of the microcontroller, for carrying out the calculation of the resistivity of the liquid in following the measure of the charge time of said capacitor.

[0020] As is understood from that described above, the laundry washing machine according to the invention has adequate means for detecting the effective introduction of washing agents to the water: in fact the value of the ionic concentration in the water, which gives an indication as to the presence of a washing agent, can be estimated, by way of the memorised knowledge base and the fuzzy logic technique, through the resistivity measure of the liquid after the introduction of said agent.

[0021] As an example, figure 2 represents in a graphical form the result of experimental research that illustrates the relation between the concentration of the detergents and the resistivity, detected with the device of figure 1, expressed in grams per litre, in the presence of a temperature of $20^{\circ}C$ (and for a water hardness value of $30^{\circ}F$).

[0022] It is however to be noted that, putting aside the temperature and water hardness in normal conditions, the difference between the ionic concentration of pure water and that of water containing detergents is considerable, for which the measuring device of figure 1 is able to independently discriminate and with ease the two different conditions.

[0023] The machine according to the invention is in the case described equipped with a dispensing device of washing agents; purely as an explanatory purpose in figure 3 only the drawer of such dispenser is schematically illustrated, indicated as a whole with 10 and divided in three distinct compartments, more precisely:

- a compartment 11, associated to the detergents for an eventual pre-wash;
- a compartment 12, associated to the detergents for

the actual washing phase;

- a compartment 13, associated to an eventual washing additive, such as a softener.

[0024] The drawer 10 is contained in an appropriate hopper container, for simplicity not represented in the figure, that has a pipe in its lower section, (F, in figure 4) in communication with the interior of the washing tub of the laundry washing machine (V, in figure 1); the hopper container then has in its superior section means (W, in figure 4) apt at selectively advancing the water from the mains to the single compartments 11, 12 and 13; such water therefore provides for withdrawing the various washing agents from said compartments and for transporting them to the washing tub, by way of the said lower pipe; the control of the means for selectively advancing the water to the various compartments is carried out by the control device of the machine.

[0025] From the above, therefore, it is understandable how the dispenser according to the invention is realised with substantially known techniques, such as for instance that described in the document EP-A-0 142 006.

[0026] The function of the abovementioned washing machine illustrated above and described in the following in relation to several different methods of use of the invention.

[0027] In a first possible case, the control device of the machine and the relative commands, are of the simplified type, i.e. realised so as that the presence of a particular phase of a "standard" washing program, characterised by the introduction of a washing agent, be considered optional or, if preferred, normally not present; in the particular case the optional phase is that of the pre-wash.

[0028] The user loads the washing machine with laundry, introduces the detergents for the washing in the compartment 12 and the additive in the compartment 13, and starts the machine selecting the said "standard" program.

[0029] At least during the first instants of the first charging of the water from the mains, such water is made to pass through compartment 11: as there are no detergents in said compartment 11, the water reaches the tub substantially pure; the device of figure 1 measures the ionic concentration of the water that has reached the tub and the microcontroller, by way of its memorised rules, is able to deduct that the pre-wash has not been requested.

[0030] The control device of the machine at this point can command the dispenser so as that the water to be charged passes through the compartment 12, for removing the detergents for the washing phase, and the washing program continues in the known manner.

[0031] It is now supposed that the user wishes to carryout a pre-wash program, for example for very dirty laundry; in this case the user introduces detergents for the pre-wash in the compartment 11, the detergents for the wash in compartment 12 and the additives in com-

partment 13, loads the laundry and starts the machine selecting the same "standard" program as mentioned above. Also in this case, at least during the initial instants of the first charging of water from the mains, this is made to pass through the compartment 11: this time however, the first water charged in the tub conveys with it the detergents contained in the compartment 11; the device of figure 1 therefore measures the ionic concentration of the water that has reached the tub and the microcontroller, by way of its memorised rules, it understands that this time the carrying out of a pre-wash is necessary: consequently the microcontroller provides for modifying in an automatic manner the selected program, so as that the control device of the machine integrates it with the pre-wash phase which is normally not provided for.

[0032] The control device of the machine therefore commands the dispenser so as that the water charged from the mains is made to pass the compartment 11 for an amount of time that allows the removal of the detergents for the pre-wash phase, and supervises in a known way the execution of such pre-wash phase; the program then continues, still in a known way, with its other phases, such as the actual wash, the rinses, the softening phase, spinning, etc.

[0033] From the two mentioned examples it is noticed how, with the same program, and thus with simple commands for the user, the method and the machine according to the invention are able to carry out or not the pre-wash phase.

[0034] As another example of application it is supposed that the user, after having loaded the laundry to be washed in the laundry washing machine, starts a washing program completely forgetting to introduce the necessary detergents in the dispenser.

[0035] With a machine according to the known art, the washing program would be executed without the detergents, with a useless waste of time and energy, and with totally unsatisfactory results. Vice-versa, the machine according to the invention is able to understand the users mistake, and eventually signal such mistake by way of appropriate means.

[0036] In fact, the moment in which the water for the actual washing phase is charged to the tub, the sensor of figure 1 checks the absence of detergents; the control device of the machine, by way of its memorised rules is able to act signalling the user.

[0037] For example an audio signal could be provided, that signals the user, and a luminous light that signals the absence of detergents; with simple and appropriate programming of the microcontroller, the control device of the machine is also able to act upon the carrying out of the washing program, for instance to interrupt the program until the user carries out a determined operation for instance, the user can open the drawer of the dispenser, insert the necessary detergents and press an appropriate confirmation button, that commands the conveying of the detergents that have just

been inserted to the tub, and then continues the program.

[0038] As an alternative, the pressing of the confirmation button could command the drainage of the water already contained in the tub, so as to repeat the program, or a single phase of which, with the correct addition of the various washing agent or agents.

[0039] It is clear that the control system of the washing machine according to the invention provides at appropriate moments for measuring the ionic concentration of the washing liquid, once the resistivity value has been detected, by way of the device of figure 1, and carries out the necessary eventual comparisons; as mentioned such measures can for example take place during the initial phase of the first loading of the water (so as to verify whether a pre-wash is necessary) and at the beginning of every single phase that requires the introduction of washing agents, for detecting the effective presence of such.

[0040] Figure 4 illustrates an explanatory example of a possible embodiment of the control system of a washing machine, in particular a laundry washing machine, realised according to the present invention.

[0041] In such figure 4, W indicates a supply pipe, apt at selectively advancing water coming from the mains to the various compartments (11-13) of the detergents dispenser 10; with F the said pipe which connects the distributor 10 to the washing tub V of the machine; R indicates the group of the components E,A,B,C and Q of the water resistivity measuring device, described with reference to figure 1; MP indicates said microcontroller, while ROM indicates the permanent memory associated to the microprocessor MP; the ROM memory contains criterion for measuring the resistivity of the washing water and for deducing its ionic concentration.

[0042] T indicates a programming device of the washing machine, for example of the electromechanical type, connected to the microcontroller MP (the presence of an electromechanical timer is obviously not necessary in the case of machines equipped with an electronic programmer); S indicates the said signalling device, for example an indicator lamp, whilst U indicates a command device, such as a confirmation button.

[0043] In figure 5 a possible logic flow diagram of the microprocessor MP of figure 4 is represented during the aforementioned "standard" phase of the washing program.

[0044] With 20 the starting block of the program is indicated; block 21 indicates the pre-wash phase, or better the admission of water coming from W in the compartment 11 of the dispenser 10: the water passes through the compartment 11 and reaches, through pipe F, the tub V of the machine; block 22 indicates the liquid resistivity measuring phase and that of deducing the presence of detergents, by way of R and MP (as described with reference to figure 1); block 23 is a control block, for deciding whether to execute the pre-wash phase: if the microcontroller MP does not detect the

presence of detergents in the washing liquid that has reached the tub V (No output), the control passes to block 24, that indicates the execution of the actual washing phase; if on the other hand MP deduces the presence of detergents (YES output), control passes to block 25, that indicates execution of the pre-wash phase.

[0045] The control therefore passes to block 26, that indicates a new resistivity measuring phase of the washing liquid, for deducing the eventual presence of detergents; block 27 indicates a control block, for deciding whether to continue with the selected washing program; if the presence of detergents is deduced (YES output), control passes to block 28, for the continuation of the "standard" program; vice-versa, if no presence of detergents is detected (NO output), control passes to block 29, that indicates the activation of signalling means S and the interruption of the washing program; block 30 is a control block, for controlling whether the user has pressed the confirmation button U: the pressing of such button is an indication of the fact that the user has received the signal (and has taken the necessary measures, such as introducing the missing detergents); when the button U is pressed (YES output), control passes to block 31, that eliminates signalling condition and passes the control to block 26. 31 indicates the end of the "standard" wash program.

[0046] It is clear that the feature described above, of warning the user and of correcting the absence of detergents, can easily be implemented for use in a dish-washing machine, even if in such machines the addition of detergents is sometimes carried out manually, directly in the tub, before the beginning of the washing cycle, or normally during the wash by way of a dispenser in which water does not pass.

[0047] It is in fact clear that the measuring of the ionic concentration of the washing liquid can be carried out with a device similar to that of figure 1, in a moment established by the control system of the dish-washer; even in this case, in conditions of an absence of detergents, the control device of the machine can provide for warning the user and/or interrupting the program and/or draining the water already present in the tub, thus allowing the addition of detergents.

[0048] As modern dish-washing machines are almost all equipped with a microcontroller, it is clear how such machine, appropriately programmed, allows for obtaining the requested information: the innovative idea could therefore have an application with washing machines having electronic control systems or, as in the case of figure 4, with the more traditional type machines, equipped with electromechanical cyclic timers, however characterised by the presence of a microcontroller in one of its electronic sub-sections (for instance the microcontroller present in a digital electronic module for controlling the motor speed in dish-washing machines).

[0049] With this purpose it is also to be noted that the implementation of the invention, according to the above-mentioned advantageous embodiment, results in being

very cost effective, due to the fact that its constituting elements are already normally part of almost all dish-washing machines; in fact the cost of the microcontroller (when not provided with the dish-washing machine) costs approximately one dollar, and, in the same way, the cost of the components of the water resistivity measuring device are practically considered to be insignificant with regards the benefits, in terms of usefulness and efficiency, offered by the control system of the machine subject of the present invention.

[0050] From the given description the characteristics and advantages of the present invention result in being clear, consisting in particular in the fact that, with simple and economic means, the efficiency and reliability of a washing machine is assured, even reducing the possibility of operative errors by the user.

[0051] Finally it is clear that numerous variants can be made to the washing machine subject of the present invention, without for this departing from the novelty principles inherent in the innovative idea.

[0052] For example it is to be mentioned the possibility of utilising the control method according to the invention in washing machines equipped with automatic dispensers, with a long autonomy, of washing agents. In such dispensers it may in fact occur that the quantity of one or more of the washing agents be finished, without the user being aware of such fact, or that the formation of lumps in the tank hinders the conveyance of the washing agents: in such case, therefore, there is the risk of washing without detergents: it is clear how according to the invention such risks can be avoided, in the above described ways.

[0053] In more sophisticated embodiments of the invention, the measure of the ionic concentration of the water could be improved, or integrated with other information, such as the water hardness and its temperature, the quantity of water charged, the type of laundry to be washed, the type of soil associated to the fabric, etc.

[0054] For instance:

- the value of the water hardness can be determined by way of measuring its initial resistivity (i.e. before the introduction of detergents), utilising the device of figure 1;
- the total quantity of water charged in the laundry washing machine can be determined with the use of an appropriate turbine flow measuring device (for example of the Hall type or of infrared rays) or using the information relating to restoring the washing water levels managed by a first level electromechanical pressure switch (note for example Italian patent application TO93A000796 in the name of the same applicant);
- the type of laundry loaded can on the other hand be detected by studying its dynamics of water absorption (note abovementioned Italian patent application TO93A000796 in the name of the same applicant);

- the type of dirt or stains and its entity, even though being entities which are difficult to measure in a direct manner, can be estimated by way of indirect measures, such as the optical detection of the turbidity of the washing liquid. An alternative method to the optical one, is based on measuring the water resistivity which is already carried out by way of the measuring device described above with reference to the figure, and therefore without the necessity of additional costs. The detection of the dirt/stains entity, by way of the said device takes on a significant importance in abnormal conditions of dirt or stains, for instance for cases in which the laundry to be washed is very dirty;
- the value of the washing water temperature can be determined by way of appropriate low cost sensors, for example based on a thermal-sensitive element of the NTC type, i.e. made up of a mixture of oxides the resistance of which varies in an inverse manner to the temperature according to an exponential type law.

[0055] It therefore appears clear how the measuring of the ionic concentration of the washing water can reach a very high level of precision, by way of appropriate elaboration of the information mentioned above (hardness, temperature, turbidity, etc.): this could also allow the washing machine to recognise the type of washing agent introduced to the tub, and for the carrying out of eventual comparisons/controls with the selected program (for example signalling whether the user has introduced a washing agent in a wrong compartment of the drawer). As already mentioned, an excellent method for enabling the coding in a compact form of the substantial mass of information that the control unit has to treat is that offered by the technology based on fuzzy logic; the knowledge base of the method according to the invention is coded, in the permanent memory of the microcontroller under the form of "rules" (IF...THEN rules) by way of the fuzzy logic technique.

Claims

1. Control method of the operation of a washing machine, said washing machine comprising:
 - control means (T) for the selection of at least one washing program comprising a plurality of different phases, during at least one of said phases the use of a washing agent and a washing liquid being provided,
 - a control system (MP) that supervises the execution of said washing program,
 - sensor means (R) that, during the machine operation, are able to detect the presence of a washing agent in the washing liquid,

wherein, at least during the initial part of a first of said phases, the washing liquid is analyzed through said sensor means (R), for deducing the eventual presence therein of a washing agent, and wherein said control system, (MP), as a function of the results of the detection carried out by said sensors means (R), is able to act upon the carrying out of the selected washing program, characterized in that:

- if the presence of the washing agent is detected within the washing liquid, the control system (MP) provides for completing the execution of said first phase, which is then followed by a second phase of the selected washing program, and
- if the presence of the washing agent is not detected within the washing liquid, the control system (MP) starts the execution of said second phase, without completing said first phase.

2. Control method, according to claim 1, characterized in that said first phase is a pre-wash phase.

3. Control method, according to claim 1, characterized in that the washing agents being necessary for carrying out one or more of said phases of the selected washing program are charged in a washing agent dispenser comprising a plurality of distinct compartments, each of said compartments being provided for containing a dose of the washing agent being necessary for a specific phase of a selectable washing program.

4. Control method, according to claim 1, characterized in that the control system (MP) provides, in function of the reached phase of the selected washing program and by way of said sensor means, (R), for verifying the eventual presence of a washing agent in the washing liquid and to control whether in said phase the introduction of a washing agent is expected.

5. Control method, according to claim 1, characterized in that the control system (MP) provides, in function of the reached phase of the selected washing program and by way of said sensor means, (R), for measuring the ionic concentration in the washing liquid and to control whether in said phase a predetermined ionic concentration is expected.

6. Control method, according to claim 4 or 5, characterized in that:

- if for the reached phase the introduction of a washing agent is expected and said sensor means (R) verify its presence, or its correct concentration, the control system of the machine

(T,MP) provides for the normal execution of the selected washing program, or

- if for the reached phase the introduction of a washing agent is expected and said sensor means (R) do not verify its presence, or measure its incorrect concentration, the control system of the machine (T,MP) provides for acting on the execution of the selected washing program, in particular for interrupting or modifying it, or for controlling signal means (S).

7. Washing machine comprising

- control means (T) for the selection of one or more washing programs, at least one of said washing programs comprising a plurality of different phases, wherein during at least one of said phases the use of a washing agent and a washing liquid is provided,
- a control system (MP) that supervises the execution of said one or more washing programs,
- sensor means (R) that, during the machine operation, are able to detect the presence of a washing agent in the washing liquid,

wherein, at least during the initial part of a first of said phases, the washing liquid is analyzed through said sensor means (R), for deducing the eventual presence of a washing agent within said washing liquid, and wherein said control system, (MP), as a function of the results of the detection carried out by said sensors means (R), is able to act upon the carrying out of the selected washing program, characterized in that means (MP,R) are provided for automatically controlling, in function of the presence or not of the washing agent within the washing liquid of said first phase, the completion of said first phase, which is then followed by a second phase of the selected washing program, or for starting the execution of said second phase without completing said first phase.

8. Washing machine, according to claim 7, characterized in that said sensor means (R) comprise a device for measuring the resistivity of the washing liquid, the presence of the washing agent being in particular detected in an indirect manner by way of the measure of the resistivity.

9. Washing machine, according to claim 8, characterized in that said device for measuring the resistivity of the washing liquid comprises two electrodes (A, B), arranged in contact with the washing liquid and inserted in the charging circuit of a capacitor (C) and means (MP,Q) for measuring the charge time (Tc) of said capacitor (C), the measure of the resistivity being obtained in an indirect manner by way of measuring the charge time (Tc).

10. Washing machine, according to one or more of the previous claims, characterized in that it comprises a microcontroller (MP), that in particular carries out the measure of the charge time (Tc) of said capacitor (C).

11. Washing machine, according to the previous claim, characterized in that it comprises permanent memory means (ROM) associated to said microcontroller (MP), in said memory means being encoded, in particular under the form of "rules", the criterion to:

- verify the presence, or measuring the concentration, of a washing agent in the washing liquid, and/or
- modify, in function of the results of the detection carried out by said sensor means (R), the carrying out of the selected washing program, and/or
- control, in function of the results of the detection carried out by said sensor means (R), signal means (S) of the incorrect dosage of the detergent in the washing water.

12. Washing machine, according to claim 7, characterized in that it comprises a washing agent dispensing device (10), having a plurality of distinct compartments (11-13), provided for containing washing agents to be introduced to the washing liquid during distinct phases of the selected washing program, means (W) apt at selectively transporting the water from the mains to the single compartments (11-13) in function of the phase of the selected washing program, means (F) for conveying to a washing tub (V) the liquid that passes through said compartments (11-13), with the relevant washing agent.

13. Washing machine, according to claim 10, characterized in that means (MP,R) are provided for detecting an incorrect dosage of a washing agent in the washing liquid.

Patentansprüche

1. Steuerverfahren für den Betrieb einer Waschmaschine, die enthält:

- Steuermittel (T) zum Auswählen zumindest eines Waschprogrammes, welches mehrere unterschiedliche Phasen aufweist, wobei während zumindest einer dieser Phasen die Verwendung eines Waschmittels und einer Waschflüssigkeit vorgesehen ist,
- ein Steuersystem (MP), das die Ausführungen des Waschprogramms überwacht,
- Sensormittel (R), die während des Maschinenbetriebs in der Lage sind, das Vorhandensein

eines Waschmittels in der Waschflüssigkeit zu erfassen,

wobei zumindest während eines Anfangsabschnitts einer ersten Phase aus diesen Phasen die Waschflüssigkeit durch die Sensormittel (R) analysiert wird, um das eventuelle Vorhandensein eines Waschmittels zu erfassen, und wobei das Steuersystem (MP) in Abhängigkeit der Ergebnisse der durch die Sensormittel (R) ausgeführten Erfassung auf die Ausführung des gewählten Waschprogrammes einwirkt,

dadurch gekennzeichnet, daß,

- wenn das Vorhandensein des Waschmittels innerhalb der Waschflüssigkeit erfaßt wird, das Steuersystem (MP) die Ausführung der ersten Phase beendet, der anschließend eine zweite Phase des gewählten Waschprogramms folgt, und
- wenn das Vorhandensein des Waschmittels nicht innerhalb der Waschflüssigkeit erfaßt wird, das Steuersystem (MP) die Ausführung der zweiten Phase ohne Beendigung der ersten Phase beginnt.

2. Steuerverfahren nach Anspruch 1,

dadurch gekennzeichnet, daß die erste Phase eine Vorwaschphase ist.

3. Steuerverfahren nach Anspruch 1,

dadurch gekennzeichnet, daß die Waschmittel, die zum Ausführen einer oder mehrerer dieser Phasen des gewählten Waschprogrammes notwendig sind, in einer Waschmittel-Abgabeeinrichtung eingefüllt werden, die mehrere voneinander getrennte Abteile aufweist, von denen jedes zur Aufnahme einer Dosis des Waschmittels vorgesehen ist, welche für eine spezifische Phase eines auswählbaren Waschprogramms notwendig ist.

4. Steuerverfahren nach Anspruch 1,

dadurch gekennzeichnet, daß das Steuersystem (MP) in Abhängigkeit der erreichten Phase des ausgewählten Waschprogramms und mittels der Sensormittel (R) die Überprüfung des eventuellen Vorhandenseins eines Waschmittels in der Waschflüssigkeit bereitstellt, um zu überwachen, ob in dieser Phase das Zuführen des Waschmittels zu erwarten ist.

5. Steuerverfahren nach Anspruch 1,

dadurch gekennzeichnet, daß das Steuersystem (MP) in Abhängigkeit der erreichten Phase des ausgewählten Waschprogramms und mittels der Sensormittel (R) das Messen der Ionenkonzentration in der Waschflüssigkeit bereitstellt, um zu überwachen, ob in dieser Phase eine vorbestimmte Ionen-

konzentration erwartet wird.

6. Steuerverfahren nach Anspruch 4 oder 5, **dadurch gekennzeichnet**, daß,

- wenn für die erreichte Phase das Zuführen eines Waschmittels erwartet wird und die Sensormittel (R) sein Vorhandensein oder seine korrekte Konzentration verifizieren, das Steuersystem der Maschine (T, MP) die normale Ausführung des ausgewählten Waschprogramms bereitstellt, oder
- wenn für die erreichte Phase das Zuführen eines Waschmittels erwartet wird und die Sensormittel (R) sein Vorhandensein nicht verifizieren oder seine unkorrekte Konzentration messen, das Steuersystem der Maschine (T, MP) auf die Ausführung des gewählten Waschprogramms, insbesondere hinsichtlich seiner Unterbrechung oder seiner Modifizierung oder auf die Steuerung von Signalmitteln (S) einwirkt.

7. Waschmaschine, enthaltend:

- Steuermittel (T) zum Auswählen eines oder mehrerer Waschprogramme, von denen zumindest eines mehrere unterschiedliche Phasen enthält, wobei während zumindest einer dieser Phasen die Verwendung eines Waschmittels und einer Waschflüssigkeit vorgesehen ist,
- ein Steuersystem (MP), das die Ausführung des einen oder der mehreren Waschprogramme überwacht,
- Sensormittel (R), die während des Maschinenbetriebs in der Lage sind, das Vorhandensein eines Waschmittels in der Waschflüssigkeit zu erfassen,

wobei zumindest während eines Anfangsabschnitts einer ersten dieser Phasen die Waschflüssigkeit durch die Sensormittel (R) analysiert wird, um das eventuelle Vorhandensein eines Waschmittels innerhalb der Waschflüssigkeit zu erfassen, und wobei das Steuersystem (MP) in Abhängigkeit der Ergebnisse der durch die Sensormittel (R) ausgeführten Erfassung in der Lage ist, auf die Ausführung des ausgewählten Waschprogramms einzuwirken, **dadurch gekennzeichnet**, daß Mittel (MP, R) zum automatischen Steuern in Abhängigkeit des Vorhandenseins oder Nichtvorhandenseins des Waschmittels innerhalb der Waschflüssigkeit der ersten Phase der Beendigung dieser ersten Phase vorgesehen sind, welche anschließend durch eine zweite Phase des ausgewählten Waschprogramms gefolgt wird, oder um die Ausführung der zweiten Phase ohne Beendigung der ersten Phase zu beginnen.

8. Waschmaschine nach Anspruch 7, **dadurch gekennzeichnet**, daß die Sensormittel (R) eine Vorrichtung zum Messen des spezifischen Widerstandes der Waschflüssigkeit aufweisen, wobei das Vorhandensein des Waschmittels insbesondere in einer indirekten Weise mittels der Messung des spezifischen Widerstands erfaßt wird.

9. Waschmaschine nach Anspruch 8, **dadurch gekennzeichnet**, daß die Vorrichtung zum Messen des spezifischen Widerstandes der Waschflüssigkeit zwei Elektroden (A, B), die in Kontakt mit der Waschflüssigkeit stehen und in der Ladeschaltung einer Kapazität (C) angeordnet sind, und weiterhin Mittel (MP, Q) zum Messen der Ladezeit (Tc) der Kapazität (C) aufweist, wobei die Messung des spezifischen Widerstandes in einer indirekten Weise mittels der Messung der Ladezeit (Tc) ausgeführt wird.

10. Waschmaschine nach einem oder mehreren der vorstehenden Ansprüche, **dadurch gekennzeichnet**, daß sie einen Mikrokontroller (MP) aufweist, der insbesondere die Messung der Ladezeit (Tc) der Kapazität (C) ausführt.

11. Waschmaschine nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet**, daß sie nicht flüchtige Speichermittel (ROM) aufweist, die mit dem Mikrokontroller (MP) zusammenwirken, wobei die Speichermittel Kriterien, die insbesondere in Form von "Regeln" codiert sind, enthalten:

- verifiziere das Vorhandensein oder messe die Konzentration eines Waschmittels in der Waschflüssigkeit, und/oder
- modifiziere in Abhängigkeit der Ergebnisse der Erfassung, die durch die Sensormittel (R) ausgeführt wird, das Ausführen des ausgewählten Waschprogramms, und/oder
- steuere in Abhängigkeit der Ergebnisse der durch die Sensormittel (R) ausgeführten Erfassung Signalmittel (S) hinsichtlich der unkorrekten Dosierung des Waschmittels in dem Waschwasser.

12. Waschmaschine nach Anspruch 7, **dadurch gekennzeichnet**, daß sie eine Waschmittel-Abgabeeinrichtung (10), welche mehrere voneinander getrennte Abteile (11-13) besitzt, die zum Aufnehmen von Waschmittel vorgesehen sind, welches der Waschflüssigkeit während unterschiedlicher Phasen des gewählten Waschprogramms zuzuführen ist, Mittel (W), die zum selektiven Transportieren des Wassers von der Wasserleitung zu den einzelnen Abteilen (11-13) in Abhängigkeit der Phase des ausgewählten Waschprogramms in der

Lage sind, und Mittel (F) zum Transportieren der Flüssigkeit zu einem Waschbottich (V) aufweist, wobei die Flüssigkeit durch die Abteile (11-13) mit dem relevanten Waschmittel hindurchgeführt wird.

13. Waschmaschine nach Anspruch 10, **dadurch gekennzeichnet**, daß Mittel (MP, R) zum Erfassen einer unkorrekten Dosierung eines Waschmittels in der Waschflüssigkeit vorgesehen sind.

Revendications

1. Procédé de commande du fonctionnement d'une machine à laver, ladite machine à laver comprenant :

- des moyens de commande (T) pour la sélection d'au moins un programme de lavage comprenant une pluralité de phases différentes, l'utilisation d'un agent de lavage et d'un liquide de lavage étant assurée pendant au moins l'une desdites phases,
- un système de commande (MP) qui supervise l'exécution dudit programme de lavage,
- des moyens détecteurs (R) qui, pendant le fonctionnement de la machine, sont capables de détecter la présence d'un agent de lavage dans le liquide de lavage,

où, au moins pendant la partie initiale d'une première desdites bases, le liquide de lavage est analysé par le biais desdits moyens détecteurs (R), pour déduire la présence éventuelle dans celui-ci d'un agent de lavage, et où ledit système de commande (MP) est capable, en fonction des résultats de la détection réalisée par lesdits moyens détecteurs (R), d'agir sur la réalisation du programme de lavage sélectionné, caractérisé en ce que :

- si la présence de l'agent de lavage est détectée dans le liquide de lavage, le système de commande (MP) assure la réalisation de l'exécution de ladite première phase, qui est ensuite suivie par une seconde phase du programme de lavage sélectionné, et
- si la présence de l'agent de lavage n'est pas détectée dans le liquide de lavage, le système de commande (MP) commence l'exécution de ladite seconde phase, sans réaliser ladite première phase.

2. Procédé de commande selon la revendication 1, caractérisé en ce que ladite première phase est une phase de pré-lavage.

3. Procédé de commande selon la revendication 1, ca-

ractérisé en ce que les agents de lavage nécessaires pour la mise en oeuvre d'une ou plusieurs desdites phases du programme de lavage sélectionné sont introduits dans un distributeur d'agents de lavage comprenant une pluralité de compartiments distincts, chacun desdits compartiments étant conçu pour contenir une dose de l'agent de lavage nécessaire pour une phase spécifique d'un programme de lavage sélectionnable.

4. Procédé de commande selon la revendication 1, caractérisé en ce que le système de commande (MP) assure, en fonction de la phase atteinte du programme de lavage sélectionné et au moyen desdits moyens détecteurs (R), la vérification de la présence éventuelle d'un agent de lavage dans le liquide de lavage et le contrôle de ce que, dans ladite phase, l'introduction d'un agent de lavage est prévue.

5. Procédé de commande selon la revendication 1, caractérisé en ce que le système de commande (MP) assure, en fonction de la phase atteinte du programme de lavage sélectionné et au moyen desdits moyens détecteurs (R), la mesure de la concentration ionique dans le liquide de lavage et le contrôle de ce que, dans ladite phase, une concentration ionique prédéterminée est prévue.

6. Procédé de commande selon la revendication 4 ou 5, caractérisé en ce que :

- si, pour la phase atteinte, l'introduction d'un agent de lavage est prévue et lesdits moyens détecteurs (R) vérifient sa présence, ou sa concentration correcte, le système de commande de la machine (T, MP) assure l'exécution normale du programme de lavage sélectionné, ou
- si, pour la phase atteinte, l'introduction d'un agent de lavage est prévue et lesdits moyens détecteurs (R) ne vérifient pas sa présence, ou mesurent sa concentration incorrecte, le système de commande de la machine (T, MP) réalise une action sur l'exécution du programme de lavage sélectionné, en particulier pour l'interrompre ou le modifier, ou pour commander des moyens signalisateurs (S).

7. Machine à laver comprenant

- des moyens de commande (T) pour la sélection d'un ou plusieurs programmes de lavage, au moins l'un desdits programmes de lavage comprenant une pluralité de phases différentes, où pendant au moins l'une desdites phases l'utilisation d'un agent de lavage et d'un liquide de lavage est assurée,
- un système de commande (MP) qui supervise l'exécution dudit ou desdits programmes de la-

- vage,
- des moyens détecteurs (R) qui, pendant le fonctionnement de la machine, sont capables de détecter la présence d'un agent de lavage dans le liquide de lavage,

où, au moins pendant la partie initiale d'une première desdites phases, le liquide de lavage est analysé par le biais desdits moyens détecteurs (R), pour déduire la présence éventuelle d'un agent de lavage dans ledit liquide de lavage, et où ledit système de commande (MP), en fonction des résultats de la détection réalisée par lesdits moyens détecteurs (R), est capable d'agir sur la réalisation du programme de lavage sélectionné, caractérisée en ce que des moyens (MP, R) sont prévus pour commander automatiquement, en fonction de la présence ou pas de l'agent de lavage dans le liquide de lavage de ladite première phase, la réalisation de ladite première phase, qui est ensuite suivie par une seconde phase du programme de lavage sélectionné, ou pour commencer l'exécution de ladite seconde phase sans réaliser ladite première phase.

- 8.** Machine à laver selon la revendication 7, caractérisée en ce que lesdits moyens détecteurs (R) comprennent un dispositif pour mesurer la résistivité du liquide de lavage, la présence du liquide de lavage étant détectée en particulier d'une manière indirecte par le biais de la mesure de la résistivité.

- 9.** Machine à laver selon la revendication 8, caractérisée en ce que ledit dispositif pour mesurer la résistivité du liquide de lavage comprend deux électrodes (A, B) disposées en contact avec le liquide de lavage et insérées dans le circuit de charge d'un condensateur (C) et des moyens (MP, Q) pour mesurer le temps de charge (Tc) dudit condensateur (C), la mesure de la résistivité étant obtenue d'une manière indirecte par le biais de la mesure du temps de charge (Tc).

- 10.** Machine à laver selon une ou plusieurs des revendications précédentes, caractérisée en ce qu'elle comprend un microprocesseur (MP), qui réalise en particulier la mesure du temps de charge (Tc) dudit condensateur (C).

- 11.** Machine à laver selon la revendication précédente, caractérisée en ce qu'elle comprend des moyens de mémoire permanente (ROM) associés audit microprocesseur (MP), moyens de mémoire dans lesquels sont codés, en particulier sous forme de "règles", les critères :

- vérifier la présence, ou mesurer la concentration, d'un agent de lavage dans le liquide de lavage, et/ou,

- modifier, en fonction des résultats de la détection réalisée par lesdits moyens détecteurs (R), la mise en oeuvre du programme de lavage sélectionné, et/ou
- commander, en fonction des résultats de la détection réalisée par lesdits moyens détecteurs (R), des moyens signalisateurs (S) du dosage incorrect du détergent dans l'eau de lavage.

- 12.** Machine à laver selon la revendication 7, caractérisée en ce qu'elle comprend un dispositif distributeur d'agents de lavage (10), ayant une pluralité de compartiments distincts (11-13), conçu pour contenir des agents de lavage à introduire dans le liquide de lavage pendant des phases distinctes du programme de lavage sélectionné, des moyens (W) capables de transporter sélectivement l'eau du réseau dans les compartiments (11-13) individuels en fonction de la phase du programme de lavage sélectionné, des moyens (F) pour transporter dans un tube de lavage (V) le liquide qui passe dans lesdits compartiments (11-13), avec l'agent de lavage pertinent.

- 13.** Machine à laver selon la revendication 10, caractérisée en ce que des moyens (MP, R) sont prévus pour détecter un dosage incorrect d'un agent de lavage dans le liquide de lavage.

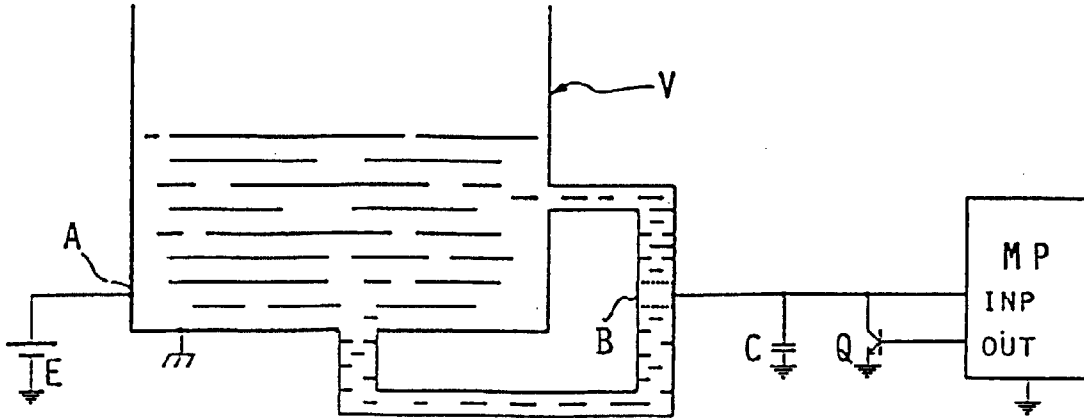


FIG. 1

MEASURES OF DETERGENT CONCENTRATION WITH THE RESISTIVITY SENSOR

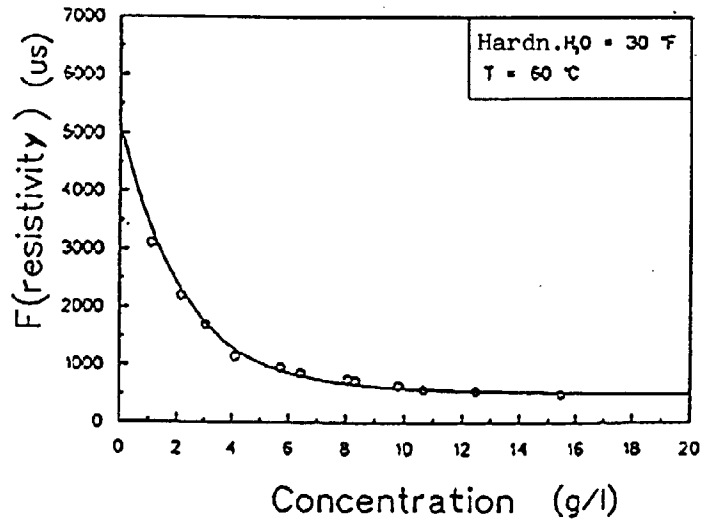


FIG. 2

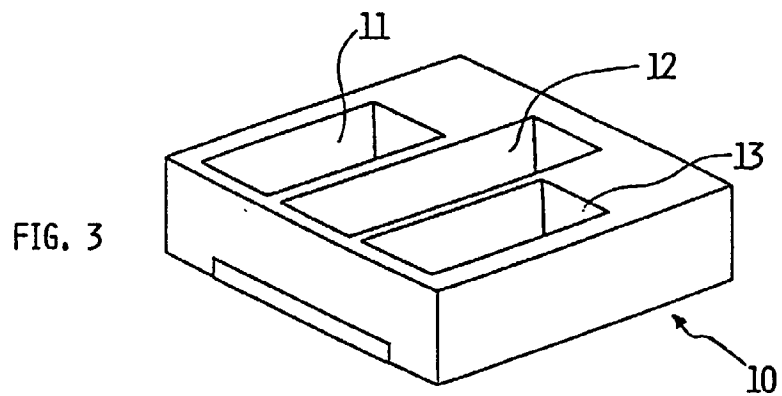


FIG. 3

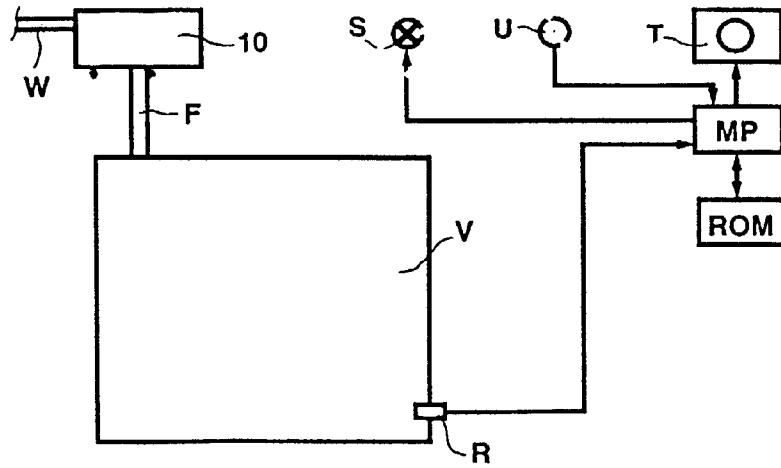


FIG. 4

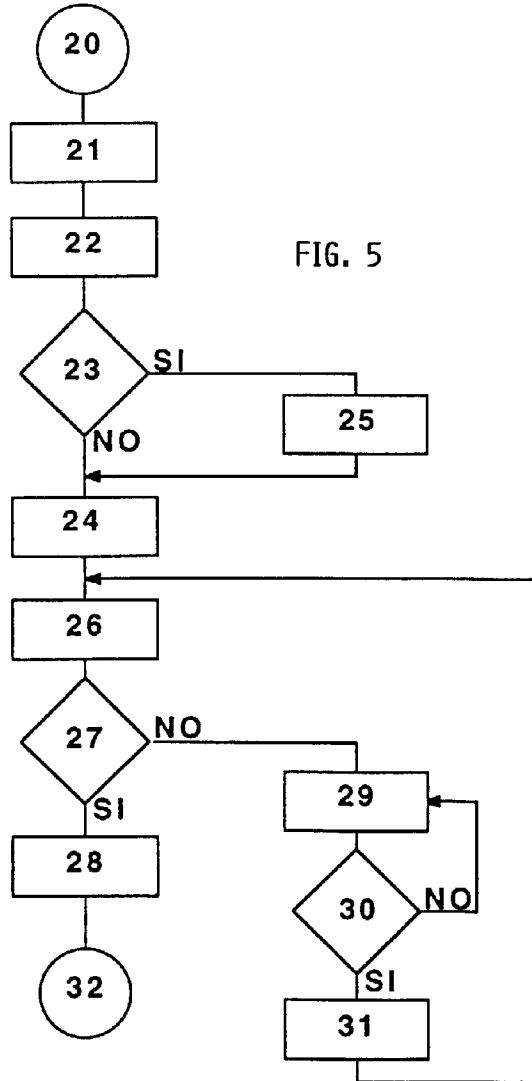


FIG. 5