

HEATING CONTROL METHOD AND APPARATUS, LAUNDRY TREATMENT DEVICE, AND STORAGE MEDIUM

[0001] This application claims priority to Chinese Patent application NO. 202010881411.1, submitted with the China National Intellectual Property Administration on August 27, 2020, and entitled with “HEATING CONTROL METHOD AND APPARATUS, LAUNDRY TREATMENT DEVICE, AND STORAGE MEDIUM”, the entire content of which is incorporated herein by reference.

FIELD

[0002] The present disclosure belongs to the technical field of electrical equipment, and more particularly, to a heating control method and apparatus, a laundry treatment device, and a storage medium.

BACKGROUND

[0003] Currently, many washing machines have a heating function for heating water in a washing tub by a heating tube disposed at a bottom of the washing tub, so as to improve washing effect. A controller of the washing machine is connected to the heating tube by an electric relay to control the heating tube to be turned on or off by the electric relay.

[0004] In a case where the washing machine has several washing tubs, two or more washing tubs may be simultaneously activated by a user. For example, if an adhesion or other failures of an electric relay corresponding to a heating tube of a certain washing tub occur, the several washing tubs may be heated and perform washing simultaneously. In this case, the washing machine has a high heating power greater than a rated power of a power cord or a power socket, which may cause the power cord to be heated and short-circuited or the power socket to be heated and deformed, resulting in a safety accident.

SUMMARY

[0005] This present disclosure proposes a heating control method and apparatus, a laundry treatment device, and a storage medium. When a heating flag indicates that a heating tube is turned off, whether an adhesion or other failures occur to an electric relay is determined by detecting a water temperature rise condition in the washing tub. When it is determined that the adhesion or other failures occur to the electric relay, the water in the washing tub is discharged, and then a temperature of the heating tube will rise rapidly to melt and break a fuse of the heating tube, so that the heating tube cannot operate any longer, thereby avoiding a simultaneous heating of several washing tubs. Therefore, it is possible to prevent a heating power from exceeding a rated power of a power cord or a power socket, avoiding safety problems caused by continuous heating of the heating tube.

[0006] According to embodiments of a first aspect of the present disclosure, provided is a heating control method, including: obtaining a heating flag for identifying an operating state of a heating tube; determining a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that the heating tube is in an off state; and controlling a drainage pump to discharge water in the washing tub, in response to determining that the current number of consecutive occurrences is greater than or equal to a predetermined number of times. For example, all the water in the washing tub is discharged, or a part of the water in the washing tub is discharged, for example, until a liquid level in the washing tub is lower than an upper surface of the heating tube or lower than a lowest point of the heating tube. As a result, a temperature of the heating tube rises rapidly to melt and break a fuse, thereby avoiding occurrence of simultaneous heating of several washing tubs.

[0007] In some embodiments of the present disclosure, said determining a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that the heating tube is in an off state includes: determining a temperature rising time length used for the water temperature in the washing tub to rise by a predetermined temperature value, in response to the heating flag indicating that the heating tube is in the off state; and increasing the current number

of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition by 1, in response to the temperature rising time length is less than or equal to a predetermined time length.

[0008] In some embodiments of the present disclosure, said determining a temperature rising time length used for the water temperature in the washing tub to rise by a predetermined temperature value, in response to the heating flag indicating that the heating tube is in the off state includes: obtaining a first water temperature in the washing tub and a first detection time corresponding to the first water temperature in response to the heating flag indicating that the heating tube is in the off state; obtaining in real time a second water temperature in the washing tub and a second detection time corresponding to the second water temperature; calculating a time difference between the second detection time and the first detection time in response to a temperature difference between the second water temperature and the first water temperature being greater than or equal to the predetermined temperature value; and determining the time difference as the temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value.

[0009] In some embodiments of the present disclosure, the method further includes zeroing the current number of consecutive occurrences in response to the temperature rising time length being greater than the predetermined time length.

[0010] In some embodiments of the present disclosure, the method further includes zeroing the current number of consecutive occurrences in response to the heating flag indicating that the heating tube is in an on state.

[0011] In some embodiments of the present disclosure, the method further includes returning to perform an operation of said obtaining a heating flag for identifying an operating state of a heating tube, in response to the current number of consecutive occurrences being smaller than the predetermined number of times.

[0012] In some embodiments of the present disclosure, the method further includes: setting a failure flag as a predetermined identifier in response to detecting that a laundry treatment device is activated; and zeroing the failure flag in response to the number of consecutive occurrences being greater than or equal to the predetermined number of times.

[0013] In some embodiments of the present disclosure, the method further includes

determining an adhesion of an electric relay corresponding to the heating tube in response to the current number of consecutive occurrences being greater than or equal to the predetermined number of times.

[0014] According to embodiments of a second aspect of the present disclosure, a heating control apparatus is provided. The heating control apparatus includes an obtaining module, a determining module, and a drainage module. The obtaining module is configured to obtain a heating flag for identifying an operating state of a heating tube. The determining module is configured to determine a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that the heating tube is in an off state, and determine that the current number of consecutive occurrences is greater than or equal to a predetermined number of times. The drainage module is configured to control a drainage pump to discharge water in the washing tub.

[0015] According to embodiments of a third aspect of the present disclosure, a laundry treatment device is provided. The laundry treatment device includes a memory, a processor, and a computer program stored on the memory and executable on the processor. The processor is configured to execute the computer program to implement the method as described in the first aspect.

[0016] In a fourth aspect of the present disclosure, a computer-readable storage medium is provided. The computer-readable storage medium has a computer program stored thereon. The program, when executed by a processor, implements the method as described in the first aspect.

[0017] The technical solutions according to the embodiments of the present disclosure have at least the following technical effects or advantages.

[0018] In the embodiments of the present disclosure, when the heating flag in the main control board indicates that the heating tube is in the off state, the current number of consecutive occurrences of the water temperature satisfying the preset temperature rise condition is recorded. When the current number of consecutive occurrences exceeds the predetermined number of times, it indicates that the water temperature rises due to the heating of the heating tube, the heating tube is turned off by controlling the electric relay to be disconnected by the main control board through the control signal, the heating tube is however not turned off actually, and it can

therefore determine that the adhesion or other failures occur to the electric relay. At this time, the drainage pump is controlled to discharge the water in the washing tub. After the water in the washing tub is discharged, the heating tube will continue the heating, and thus the temperature of the heating tube will rise rapidly, which may cause the fuse in the heating tube to be melted and broken. After the fuse is melted and broken, the heating tube cannot operate any longer, avoiding simultaneous heating of several washing tubs, preventing the heating power of the laundry treatment device from exceeding the rated power of the power cord or the power socket, and avoiding the safety problem caused by the continuous heating of the heating tube.

[0019] Additional aspects and advantages of the present disclosure will be provided in part in the following description, or will become apparent in part from the following description, or can be learned from practicing of the present disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020] Various other advantageous and benefits will become apparent to those of ordinary skill in the art upon reading the following detailed description of preferred embodiments. The accompanying drawings are merely for the purpose of illustrating the preferred embodiments, and are not intended to limit the present disclosure. In addition, same parts or components are denoted by same reference numerals throughout the accompanying drawings, in which:

[0021] FIG. 1 shows a schematic flow chart of a heating control method according to an embodiment of the present disclosure;

[0022] FIG. 2 shows another schematic flowchart of a heating control method according to an embodiment of the present disclosure;

[0023] FIG. 3 shows a schematic structural diagram of a heating control apparatus according to an embodiment of the present disclosure;

[0024] FIG. 4 shows a schematic structural diagram of a laundry treatment device according to an embodiment of the present disclosure; and

[0025] FIG 5 shows a schematic diagram of a storage medium according to an embodiment of the present disclosure.

DETAILED DESCRIPTION

[0026] Exemplary embodiments of the present disclosure will be described in more detail below with reference to the accompanying drawings. Although exemplary embodiments of the present disclosure are shown in the accompanying drawings, it should be understood that the present disclosure may be embodied in various forms and should not be limited to the embodiments set forth herein. Rather, these embodiments are provided for thorough understanding of the present disclosure and full conveying of the scope of the present disclosure to those skilled in the art.

[0027] It should be noted that, unless otherwise specified, technical terms or scientific terms used herein shall have general meanings understood by those skilled in the art.

[0028] A heating control method, a heating control apparatus, a laundry treatment device, and a storage medium according to embodiments of the present disclosure will be described below with reference to the accompanying drawings.

[0029] According to embodiments of the present disclosure, a heating control method is provided and applied to a laundry treatment device. The laundry treatment device may be a single-tub washing machine, a double-tub washing machine, or a washing machine with more than two washing tubs. Each washing tub of the laundry treatment device performs washing in a front-loading or top-loading washing manner.

[0030] Each washing tub of the laundry treatment device is equipped correspondingly with a main control board, a heating tube, and an electric relay corresponding to the heating tube. For a certain washing tub, the heating tube is disposed at a bottom of the washing tub, and is connected to the main control board corresponding to the washing tub by the electric relay. An execution body of the embodiments of the present disclosure may be the main control board corresponding to the washing tub. The main control board is configured to determine whether an adhesion or other failures occur to the electric relay of the heating tube of the washing tub controlled by the main control board by the method according to the embodiments of the present disclosure, and discharge water in the washing tub upon determining that the adhesion or other failures occur to the electric relay. For example, all the water in the washing tub is discharged, or a part of the water in the washing tub is discharged, for example, until a liquid level in the

washing tub is lower than an upper surface of the heating tube or lower than a lowest point of the heating tube. As a result, a temperature of the heating tube at the bottom of the washing tub rises rapidly to melt and break a fuse in the heating tube, to stop the heating of the heating tube, thereby avoiding occurrence of simultaneous heating of several washing tubs. Therefore, it prevents a heating power of the laundry treatment device from exceeding a rated power of a power cord or a power socket, reducing safety problems caused by the adhesion or other failures of the electric relay.

[0031] The main control board corresponding to each washing tub of the laundry treatment device may perform electric relay adhesion protection by a method according to the embodiments of the present disclosure. As shown in FIG. 1, the method includes the following steps 101 to 103.

[0032] At step 101, a heating flag for identifying an operating state of a heating tube is obtained.

[0033] The laundry treatment device controls, by the main control board, the heating tube to be turned on or turned off. The main control board maintains one heating flag for identifying the operating state of the heating tube. The operating state of the heating tube is indicated by a predetermined character. For example, an on state is indicated by character 1, and an off state is indicated by character 0; or the on state is indicated by character 01, and the off state is indicated by character 10.

[0034] The main control board is configured to set the heating flag as a character indicating the on state while sending a control signal for turning on the heating tube to the electric relay corresponding to the heating tube. The main control board is configured to set the heating flag as a character indicating the off state while sending a control signal for turning off the heating tube to the electric relay.

[0035] In the embodiments of the present disclosure, when the laundry treatment device is activated by a user, the main control board is powered on, and a start signal is detected, the main control board reads a value of the heating flag.

[0036] At step 102, a current number of consecutive occurrences of a water temperature in the washing tub satisfying a predetermined temperature rise condition is determined in response to the heating flag indicating that the heating tube is in the off state.

[0037] The main control board determines a current operating state of the heating tube based on a value of the heating flag obtained in step 101. Assuming that the character 1 is predetermined to indicate the on state and the character 0 is predetermined to indicate the off state, the current operating state of the heating tube is determined as the on state when the value of the heating flag read by the main control board is 1, and the current operating state of the heating tube is determined as the off state when the value of the heating flag read by the main control board is 0.

[0038] When it is determined that the value of the heating flag indicates that the heating tube is in the off state, it means that the main control board has previously sent a control signal for turning off the heating tube to the electric relay of the heating tube. If an adhesion or other failures occur to the electric relay, the heating tube is not turned off and still performs the heating, and a water temperature in the washing tub will continue to rise. Therefore, under the premise that the heating flag indicates that the heating tube is in the off state, the detection of the change in the water temperature in the washing is helpful to determine whether the adhesion or other failures occur to the electric relay of the heating tube.

[0039] In the embodiments of the present disclosure, the main control board determines the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition in response to the heating flag indicating that the heating tube is in the off state. A temperature sensor is disposed in the washing tub of the laundry treatment device, and the temperature sensor is connected to the main control board. The water temperature in the washing tub is detectable by the temperature sensor. The predetermined temperature rise condition may be that a time length used for the water temperature to rise by a temperature value that exceeds a predetermined temperature value is less than or equal to a predetermined time length. The predetermined temperature value may be 2°C or 3°C, etc., and the predetermined time length may be 4 minutes or 5 minutes, etc. Specific values of the predetermined temperature value and the predetermined time length are not limited in the embodiments of the present disclosure, and may be set as desired.

[0040] According to the indication of the heating flag that the heating tube is in the off state, the main control board first determines a temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value. The main

control board obtains a current water temperature in the washing tub by the temperature sensor upon determining that the heating flag indicates that the heating tube is in the off state. In the embodiments of the present disclosure, the current water temperature detected when it is determined that the heating tube is in the off state is referred to as a first water temperature, and a first detection time corresponding to the first water temperature is recorded. Instead of rapidly and immediately rising to a high temperature, the water temperature will buffer for a certain period of time after heating, and rise slowly in an early stage. Thus, after it is determined that the heating tube is in the off state, the first water temperature may be obtained after an interval of a predetermined time length. For example, the water temperature may be detected after an interval of 1 minute or 2 minutes.

[0041] After the first water temperature and its corresponding first detection time are obtained, the water temperature in the washing tub is obtained in real time by the temperature sensor. In the embodiments of the present disclosure, the water temperature obtained in real time is referred to as a second water temperature, and a second detection time corresponding to the second water temperature is recorded. Every time when the second water temperature and the second detection time corresponding to the second water temperature are obtained, the main control board calculates a difference between the first water temperature and the second water temperature, and compares the difference with the predetermined temperature value. If the difference is smaller than the predetermined temperature value, the second water temperature in the washing tub is obtained again by the temperature sensor in real time. If the difference is greater than or equal to the predetermined temperature value, a difference between the second detection time corresponding to the second water temperature and the first detection time corresponding to the first water temperature is calculated, and the difference is determined as the temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value. Then, the temperature rising time length is compared with the predetermined time length. If the temperature rising time length is less than or equal to the predetermined time length, it is determined that the water temperature in the washing tub has increased by the predetermined temperature value within the predetermined time length. Thus, it is determined that this time of temperature rise is caused by the heating of the heating tube, excluding the possibility in which the water temperature rise is caused by change of an ambient

temperature, it is determined that the water temperature in the washing tub satisfies the predetermined temperature rise condition, and the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition are increased by 1.

5 **[0042]** In the embodiments of the present disclosure, if it is determined that the above temperature rising time length is greater than the predetermined time length, it is determined that this time of temperature rise is caused by the change of the ambient temperature, rather than by the heating of the heating tube. In this case, it is determined that the heating flag indicates that the heating tube is in the off state, and the heating tube is actually in the off state,
10 and no problems such as the adhesion occur to the electric relay corresponding to the heating tube. Thus, the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition is zeroed.

[0043] In some embodiments of the present disclosure, if the main control board determines that the heating flag indicates that the heating tube is in the on state, it means that the main
15 control board has previously sent a control signal for turning on the heating tube to the electric relay, and the turning on of the heating tube is a normal washing procedure. In this case, the current number of consecutive occurrences is zeroed.

[0044] At step 103, a drainage pump is controlled to discharge the water in the washing tub, in response to determining that the current number of consecutive occurrences is greater than
20 or equal to a predetermined number of times.

[0045] After determining the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition in the above step 102, the current number of consecutive occurrences is compared with the predetermined number of times. The predetermined number of times may be 4 or 5, which is
25 not limited in the embodiments of the present disclosure and may be set as desired in practical applications.

[0046] When the comparison reveals that the current number of consecutive occurrences is greater than or equal to the predetermined number of times, it means that the water temperature in the washing tub still continues to rise when the heating tube is controlled by main control
30 board to be turn off, indicating that the heating tube is not actually turned off. As a result, it can

be determined that the adhesion or other failures occur to the electric relay corresponding to the heating tube.

[0047] In the case where the adhesion or other failures occur to the electric relay, the heating tube cannot be effectively controlled by the main controller, and thus will continue heating. In order to avoid safety problems caused by the continuous heating of the heating tube, in the embodiments of the present disclosure, after it is determined that the adhesion or other failures occur to the electric relay, the drainage pump connected to a water outlet of the washing tub is controlled to be activated, and the water in the washing tub is discharged through the drainage pump. After the water in the washing tub is discharged, the heating tube continues heating, and thus a temperature of the heating tube will rise rapidly. Thus, the fuse in the heating tube will be melted and broken. After the fuse is melted and broken, the heating tube cannot operate any longer, thereby avoiding the safety problems caused by the continuous heating of the heating tube. After the fuse is melted and broken, although the washing tub corresponding to the heating tube has no heating function, other washing functions such as rinsing and dehydration can still be used normally.

[0048] Since the temperature of the heating tube itself is normally high after the heating tube is turned off, the water temperature in the washing tub will continue rising until the temperature of the heating tube is smaller than or equal to the water temperature in the washing tub. Therefore, when the main control board determines through comparison that the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition is smaller than the predetermined number of times, an increase in the water temperature in the washing tub may be caused by the continuous heating of the heating tube due to the adhesion or other failures of the electric relay, or caused by the high temperature of the heating tube after the heating tube is turned off. Therefore, when the current number of consecutive occurrences is smaller than the predetermined number of times, the method returns back to step 101 to re-obtain the heating flag for identifying the operating state of the heating tube, and step 101 to step 103 are performed in a loop, until it is determined that the current number of consecutive occurrences is greater than or equal to the predetermined number of times. At this time, it is determined that the adhesion or other failures occur to the electric relay corresponding to the heating tube, and the drainage pump is controlled to

discharge the water in the washing tub.

[0049] In the embodiments of the present disclosure, a failure flag may also be maintained in the main control board. The main control board sets the failure flag as a predetermined identifier in response to detecting that the laundry treatment device is activated. The predetermined identifier may be 1 or 01, etc. The failure flag is used to identify a one-time determining process of the adhesion or other failures of the electric relay. After it is determined in step 103 that the number of consecutive occurrences is greater than or equal to the predetermined number of times and the adhesion or other failures occur to the electric relay corresponding to the heating tube, the failure flag is zeroed. In some embodiments, when the current number of consecutive occurrences is smaller than the predetermined number of times during the entire washing process and no failure such as the electric relay adhesion is determined, the failure flag is zeroed at an end of the washing procedure.

[0050] In order to facilitate the understanding of the electric relay adhesion protection solution according to the embodiments of the present disclosure, the description thereof will be explained in connection with the accompanying drawings. As shown in FIG. 2, at step S1: the failure flag is set as the predetermined identifier in response to detecting that the laundry treatment device is activated. At step S2: whether the heating tube is in the off state is determined based on the heating flag; if yes, the method proceeds to step S3; if no, the method proceeds to step S12. At step S3: whether a certain period of time has elapsed after the heating tube is turned off is determined; if yes, the method proceeds to step S4; if no, the method continues to proceed to step S3. At step S4: the first water temperature in the washing tub and the first detection time corresponding to the first water temperature are obtained. At step S5: the second water temperature in the washing tub and the second detection time corresponding to the second water temperature are obtained in real time. At step S6: whether the temperature difference between the second water temperature and the first water temperature is greater than or equal to the predetermined temperature value is determined; if yes, the method proceeds to step S7; if no, the method proceeds to step S5. At step S7: whether the time difference between the second detection time and the first detection time is smaller than or equal to the predetermined time length is determined; if yes, the method proceeds to step S8; if no, the method proceeds to step S12. At step S8: the current number of consecutive occurrences of the

water temperature in the washing tub satisfying the predetermined temperature rise condition is increased by 1. At step S9: whether the current number of consecutive occurrences is greater than or equal to the predetermined number of times is determined; if yes, the method proceeds to step S10; if no, the method proceeds to step S2. At step S10: the failure flag is zeroed. At step S11: it is determined that the adhesion or other failures occur to the electric relay corresponding to the heating tube, the drainage pump is controlled to discharge the water in the washing tub, and then the heating tube is heated in a dry state to melt and break the fuse. At step S12: the current number of consecutive occurrences is zeroed, and then the method proceeds to step S2.

[0051] In the embodiments of the present disclosure, when the heating flag in the main control board indicates that the heating tube is in the off state, the change of the water temperature in the washing tub is detected, and the current number of consecutive occurrences of the water temperature satisfying the predetermined temperature rise condition is recorded. Further, when the current number of consecutive occurrences exceeds the predetermined number of times, it indicates that the water temperature rises due to the heating of the heating tube, the heating tube is turned off by controlling the electric relay to be disconnected by the main control board through the control signal, the heating tube is however not turned off actually, and therefore, it can be determined that the adhesion or other failures occur to the electric relay. In this case, the drainage pump is controlled to discharge the water in the washing tub. After the water in the washing tub is discharged, the heating tube will continue the heating, and thus the temperature of the heating tube will rise rapidly, which may cause the fuse in the heating tube to be melted and broken. After the fuse is melted and broken, the heating tube cannot operate any longer, thereby avoiding simultaneous heating of several washing tubs, preventing the heating power of the laundry treatment device from exceeding the rated power of the power cord or the power socket, and avoiding the safety problem caused by the continuous heating of the heating tube.

[0052] According to embodiments of the present disclosure, a heating control apparatus is provided and configured to implement the heating control method in any of the above embodiments. As shown in FIG. 3, the heating control apparatus includes an obtaining module 301, a determining module 302, and a drainage module 303.

[0053] The obtaining module 301 is configured to obtain a heating flag for identifying an operating state of a heating tube.

[0054] The determining module 302 is configured to determine a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that a heating tube is in an off state, and determine that the current number of consecutive occurrences is greater than or equal to a predetermined number of times.

[0055] The drainage module 303 is configured to control a drainage pump to discharge water in the washing tub.

[0056] The determining module 302 is further configured to determine a temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value, in response to the heating flag indicating that the heating tube is in the off state; and increase the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition by 1, in response to the temperature rising time length is less than or equal to a predetermined time length.

[0057] The determining module 302 is specifically configured to: obtain a first water temperature in the washing tub and a first detection time corresponding to the first water temperature in response to the heating flag indicating that the heating tube is in the off state; obtain in real time a second water temperature in the washing tub and a second detection time corresponding to the second water temperature; calculate a time difference between the second detection time and the first detection time in response to a temperature difference between the second water temperature and the first water temperature being greater than or equal to the predetermined temperature value; and determine the time difference as the temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value.

[0058] The heating control apparatus further includes a zeroing module configured to zero the current number of consecutive occurrences in response to the temperature rising time length being greater than the predetermined time length; and zero the current number of consecutive occurrences in response to the heating flag indicating that the heating tube is in an on state.

[0059] The obtaining module 301 is further configured to obtain the heating flag for

identifying the operating state of the heating tube, in response to the number of consecutive occurrences being smaller than the predetermined number of times.

[0060] The heating control apparatus further includes a failure flag maintenance module configured to: set the failure flag as a predetermined identifier in response to detecting that the laundry treatment device is activated; and zero the failure flag in response to the number of consecutive occurrences being greater than or equal to the predetermined number of times.

[0061] The heating control apparatus further includes an adhesion determining module configured to determine an adhesion of an electric relay corresponding to the heating tube in response to the number of consecutive occurrences being greater than or equal to the predetermined number of times.

[0062] The heating control apparatus according to the above embodiments of the present disclosure is based on the same inventive concept as the heating control method according to the embodiments of the present disclosure, and has the same beneficial effects as the method used, executed or implemented by application programs stored on the heating control apparatus.

[0063] According to embodiments of the present disclosure, a laundry treatment device is provided to implement the heating control method as described above. The laundry treatment device may be a single-tub washing machine, a double-tub washing machine, or a washing machine with more than two washing tubs, and each washing tub of the laundry treatment device may perform washing in a front-loading or top-loading washing manner. FIG. 4 shows a schematic diagram of the laundry treatment device according to some embodiments of the present disclosure. As shown in FIG. 4, the laundry treatment device 2 includes a processor 200, a memory 201, a bus 202, and a communication interface 203. The processor 200, the communication interface 203, and the memory 201 are connected to each other via the bus 202. A computer program executable on the processor 200 is stored in the memory 201. The processor 200 implements the heating control method according to any one of the above embodiments of the present disclosure when executing the computer program.

[0064] The memory 201 may include a high-speed Random Access Memory (RAM), and may also include a non-volatile memory such as at least one disk memory. A communication connection between the system network element and at least one other network element is realized through at least one communication interface 203 in a wired or wireless manner, and

Internet, a wide area network, a local network, a metropolitan area network, or the like may be used.

[0065] The bus 202 may be an ISA bus, a PCI bus, an EISA bus, or the like. The bus may be divided into an address bus, a data bus, a control bus, and the like. The memory 201 is configured to store a program thereon, and the processor 200 is configured to execute the program after receiving an execution instruction. The heating control method disclosed in any one of the above embodiments of the present disclosure can be applied to the processor 200, or implemented by the processor 200.

[0066] The processor 200 may be an integrated circuit chip with signal processing capability. During an implementation, each step of the above method may be implemented by an integrated logic circuit of hardware in the processor 200 or instructions in the form of software. The above processor 200 may be a general-purpose processor including a central processing unit (CPU), a network processor (NP), and the like, a digital signal processor (DSP), an application-specific integrated circuit (ASIC), a field programmable gate array (FPGA), or other programmable logic devices, discrete gate or transistor logic devices, discrete hardware components. Various methods, steps, and logic block diagrams disclosed in the embodiments of the present disclosure may be implemented or performed. The general-purpose processor may be a microprocessor or any conventional processor, etc. The steps of the method disclosed in connection with the embodiments of the present disclosure may be directly implemented by a hardware decoding processor, or implemented by a combination of hardware and software modules in the decoding processor. The software module may be located in well-known storage medium in the art such as a random access memory, a flash memory, a read-only memory, a programmable read-only memory, an electrically erasable programmable memory, or a register. The storage medium is located in the memory 201, and the processor 200 is configured to read information in the memory 201, and implement the steps of the above method in combination with its hardware.

[0067] The laundry treatment device according to the embodiments of the present disclosure is based on the same inventive concept as the heating control method according to the embodiments of the present disclosure, and has the same beneficial effects as the method used, executed or implemented by the laundry treatment device.

[0068] According to embodiments of the present disclosure, provided is a computer-readable storage medium corresponding to the heating control method according to the above embodiments. Referring to FIG. 5, the illustrated computer-readable storage medium is a compact disc 30 having a computer program, i.e., a program product, stored thereon. The computer program, when executed by a processor, implements the heating control method according to any one of the above embodiments.

[0069] It should be noted that examples of the computer-readable storage medium may also include, but are not limited to, a phase change memory (PRAM), a static random access memory (SRAM), a dynamic random access memory (DRAM), random Access memories (RAMs) of other types, a read only memory (ROM), an electrically erasable programmable read only memory (EEPROM), a flash memory, or other optical and magnetic storage media, which will not be described in detail herein.

[0070] The computer-readable storage medium according to the above embodiments of the present disclosure is based on the same inventive concept as the heating control method according to the embodiments of the present disclosure, and has the same beneficial effects as the method used, executed, or implemented by the stored application program.

[0071] It should be noted that numerous specific details are set forth in the description herein. However, it should be understood that the embodiments of the present disclosure may be practiced without these specific details. In some examples, well-known structures and techniques are not shown in detail in order not to obscure the understanding of this description.

[0072] Similarly, it should be understood that in the above description of exemplary embodiments of the present disclosure, various features of the present disclosure are sometimes grouped in a single embodiment, accompanying drawing, or description thereof, in order to simplify the present disclosure and to facilitate understanding of one or more of the various inventive aspects. The method according to the present disclosure, however, is not to be interpreted as reflecting a schematic representation in which the claimed disclosure requires more features than those expressly recited in each claim. More specifically, as reflected by the appended claims, inventive aspects are intended for fewer features than all features of a single embodiment as described above. Thus, claims following the detailed description are hereby expressly incorporated into this detailed description, with each claim severing as a separate

embodiment of the present disclosure

[0073] In addition, it will be appreciated by those skilled in the art that although some embodiments described herein include some features included in other embodiments rather than include other features, combinations of features from different embodiments are meant to be within the scope of the present disclosure and form different embodiments. For example, in the following claims, any of the claimed embodiments may be used in any combination.

[0074] The above is merely preferred embodiments of the present disclosure. However, the scope of the present disclosure is not limited thereto. Changes or substitutions readily conceived by those skilled in the art within the scope of the present disclosure shall fall within the scope of the present disclosure. Therefore, the scope of the present disclosure should be defined by the scope of the claims.

CLAIMS

What is claimed is:

1. A heating control method, comprising:

obtaining a heating flag for identifying an operating state of a heating tube;

5 determining a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that the heating tube is in an off state; and

 controlling a drainage pump to discharge water in the washing tub, in response to determining that the current number of consecutive occurrences is greater than or equal to a
10 predetermined number of times.

2. The heating control method according to claim 1, wherein said determining a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature rise condition, in response to the heating flag indicating that the heating tube is in an off state comprises:

15 determining a temperature rising time length used for the water temperature in the washing tub to rise by a predetermined temperature value, in response to the heating flag indicating that the heating tube is in the off state; and

 increasing the current number of consecutive occurrences of the water temperature in the washing tub satisfying the predetermined temperature rise condition by 1, in response to the
20 temperature rising time length is less than or equal to a predetermined time length.

3. The heating control method according to claim 2, wherein said determining a temperature rising time length used for the water temperature in the washing tub to rise by a predetermined temperature value, in response to the heating flag indicating that the heating tube is in the off state comprises:

25 obtaining a first water temperature in the washing tub and a first detection time corresponding to the first water temperature in response to the heating flag indicating that the heating tube is in the off state;

 obtaining in real time a second water temperature in the washing tub and a second

detection time corresponding to the second water temperature;

calculating a time difference between the second detection time and the first detection time in response to a temperature difference between the second water temperature and the first water temperature being greater than or equal to the predetermined temperature value; and

5 determining the time difference as the temperature rising time length used for the water temperature in the washing tub to rise by the predetermined temperature value.

4. The heating control method according to claim 2, further comprising:

zeroing the current number of consecutive occurrences in response to the temperature rising time length being greater than the predetermined time length.

10 5. The heating control method according to any one of claims 1 to 4, further comprising:

zeroing the current number of consecutive occurrences in response to the heating flag indicating that the heating tube is in an on state.

6. The heating control method according to any one of claims 1 to 4, further comprising:

15 returning to perform an operation of said obtaining a heating flag for identifying an operating state of a heating tube, in response to the current number of consecutive occurrences being smaller than the predetermined number of times.

7. The heating control method according to any one of claims 1 to 4, further comprising:

setting a failure flag as a predetermined identifier in response to detecting that a laundry treatment device is activated; and

20 zeroing the failure flag in response to the number of consecutive occurrences being greater than or equal to the predetermined number of times.

8. The heating control method according to any one of claims 1 to 4, further comprising:

25 determining an adhesion of an electric relay corresponding to the heating tube in response to the current number of consecutive occurrences being greater than or equal to the predetermined number of times.

9. A heating control apparatus, comprising:

an obtaining module configured to obtain a heating flag for identifying an operating state of a heating tube;

30 a determining module configured to determine a current number of consecutive occurrences of a water temperature in a washing tub satisfying a predetermined temperature

rise condition, in response to the heating flag indicating that the heating tube is in an off state, and determine that the current number of consecutive occurrences is greater than or equal to a predetermined number of times; and

5 a drainage module configured to control a drainage pump to discharge water in the washing tub.

10. A laundry treatment device, comprising:

a memory;

a processor; and

a computer program stored on the memory and executable on the processor,

10 wherein the processor is configured to execute the computer program to implement the method according to any one of claims 1 to 8.

11. A computer-readable storage medium, having a computer program stored thereon, wherein the program, when executed by a processor, implements the method according to any one of claims 1 to 8.