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

(11) **EP 4 321 676 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
14.02.2024 Bulletin 2024/07

(21) Application number: **21935812.4**

(22) Date of filing: **08.11.2021**

(51) International Patent Classification (IPC):
D06F 58/36 *(2020.01)*

(52) Cooperative Patent Classification (CPC):
D06F 58/44; D06F 58/203; D06F 58/45;
D06F 2103/24; D06F 2103/38; D06F 2105/40;
D06F 2105/48

(86) International application number:
PCT/CN2021/129375

(87) International publication number:
WO 2022/213594 (13.10.2022 Gazette 2022/41)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(30) Priority: **08.04.2021 CN 202110378907**

(71) Applicant: **Wuxi Little Swan Electric Co., Ltd.**
Wuxi, Jiangsu 214028 (CN)

(72) Inventors:
- **CUI, Yuexin**
  Wuxi, Jiangsu 214028 (CN)
- **ZHOU, Cunling**
  Wuxi, Jiangsu 214028 (CN)

(74) Representative: **Haseltine Lake Kempner LLP**
Cheapside House
138 Cheapside
London EC2V 6BJ (GB)

(54) **CONTROL METHOD, APPARATUS AND DEVICE, AND COMPUTER-READABLE STORAGE MEDIUM**

(57) A control method, apparatus and device, and a computer-readable storage medium, which are applied to a laundry processing device. The method comprises: when it is determined that the rotational speed of a tub body (21) of a laundry processing device (20) reaches a first rotational speed, controlling a steam generation apparatus (25) of the laundry processing device (20) to stop generating steam, wherein the first rotational speed is greater than or equal to a critical rotational speed.

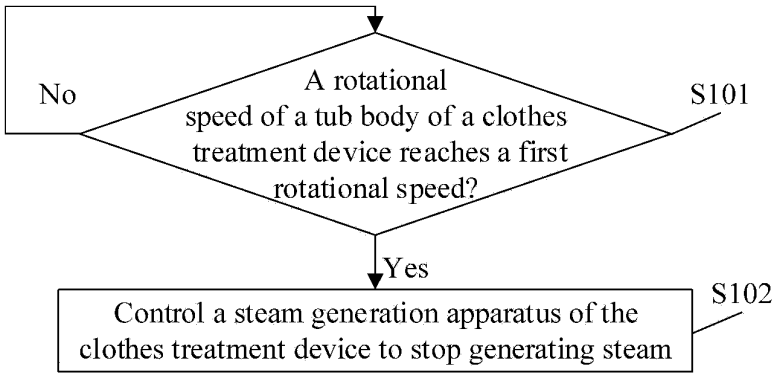

FIG. 1

EP 4 321 676 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is filed based on and claims priority to Chinese Patent application No. 202110378907.1 filed on April 8, 2021 and entitled "CONTROL METHOD, APPARATUS AND DEVICE, AND COMPUTER-READABLE STORAGE MEDIUM", the contents of which are hereby incorporated by reference in its entirety.

TECHNICAL FIELD

[0002] The application relates to the technical field of automatic control, and in particular to a control method, a control apparatus, a control device, and a computer-readable storage medium.

BACKGROUND

[0003] A clothes dryer is a cleaning-type household appliance which instantly evaporates and dries moisture in washed clothes by using electric heating. It is especially required in the winter of northern areas and the "returning to the south" weather of southern areas where clothes are difficult to dry. With the continuous improvement of living standards, people's requirements for clothing become higher and higher.

[0004] Most of traditional clothes dryers dry the clothes by way of hot air circulation. Although the hot air may implement certain care effects such as sterilization, deodorization and other care effects of the clothes, the care effects are not apparent.

SUMMARY

[0005] In view of this, embodiments of the application provide a control method, a control apparatus, a control device, and a computer-readable storage medium.

[0006] An embodiment of the application provides a control method, the control method is applied to a clothes treatment device, and includes the following operations.

[0007] It is determined that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and a steam generation apparatus of the clothes treatment device is controlled to stop generating steam. The first rotational speed is equal to or greater than a critical rotational speed.

[0008] In some embodiments, the method may further include the following operations.

[0009] The clothes treatment device is controlled to operate in a first operation mode.

[0010] The first operation mode includes: turning off the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0011] In some embodiments, the method may include the following operations.

[0012] The clothes treatment device is controlled to operate in a second operation mode.

[0013] The second operation mode includes: turning on the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0014] In some embodiments, the method may include the following operations.

[0015] The tub body is controlled to operate at a second rotational speed and then operate at a third rotational speed.

[0016] The third rotational speed is equal to or greater than the second rotational speed, and both the second rotational speed and the third rotational speed are less than the critical rotational speed.

[0017] In some embodiments, the method may further include the following operations.

[0018] It is determined that a duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration, and the tub body is controlled to operate at the first rotational speed.

[0019] In some embodiments, the method may further include the following operations.

[0020] The tub body is controlled to operate at a first beat.

[0021] The first beat includes a first rotation duration and a first stop duration, the first rotation duration is equal to or greater than a rotation duration threshold, and the first stop duration is less than or equal to a stop duration threshold.

[0022] In some embodiments, the method may further include the following operations.

[0023] The clothes treatment device is controlled to operate in a third operation mode.

[0024] The third operation mode includes: turning on the steam generation apparatus, turning off a drying fan of the clothes treatment device, and turning off a drying heater of the clothes treatment device.

[0025] In some embodiments, the method may further include the following operations.

[0026] The tub body is controlled to operate at a second beat.

[0027] The second beat includes a second rotation duration and a second stop duration, the second rotation duration is less than the rotation duration threshold, the second stop duration is less than or equal to the stop duration threshold, and the second beat is weaker than the first beat.

[0028] An embodiment of the application provides a control apparatus, the control apparatus is applied to a clothes treatment device, and includes a first control module.

[0029] The first control module is configured to determine that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and control a steam generation apparatus of the clothes treatment device to stop generating steam. The first rotational

speed is equal to or greater than a critical rotational speed.

[0030] An embodiment of the application provides a control device, the control device includes a memory and a processor.

[0031] The memory is configured to store executable instructions.

[0032] The processor is configured to implement operations of the above control method when the processor executes the executable instructions stored in the memory.

[0033] An embodiment of the application provides a computer-readable storage medium, having stored thereon computer-executable instructions. The computer-executable instructions are configured to perform operations of the above control method.

[0034] The embodiments of the application provide a control method, a control apparatus, a control device, and a computer-readable storage medium, which are applied to a clothes treatment device. The method includes the following operations. It is determined that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and a steam generation apparatus of the clothes treatment device is controlled to stop generating steam. The first rotational speed is equal to or greater than a critical rotational speed. In this way, before the rotational speed of the tub body reaches the first rotational speed, the steam generation apparatus is turned on to generate steam, and the steam is used to implement care functions such as dust removal, wrinkle removal, deodorization, sterilization and other care functions of the clothes in the tub body, which may effectively improve clothes care effect; after the rotational speed of the tub body reaches the critical rotational speed, the clothes in the tub body are affixed to a tub wall and are not present at the center of the tub body. At this time, the steam generation apparatus is turned off to stop generating steam, which reduces energy consumption of the clothes treatment device and prevents the steam from passing through the center of the tub body without clothes, thus resulting in waste; furthermore, after generation of the steam is stopped, the steam introduced into the tub body is reduced, which may reduce humidity of the clothes in the tub body and improve clothes treatment efficiency.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035] In the drawings (which are not necessarily drawn to scale), similar reference numerals may describe similar components in different views. The drawings generally illustrate various embodiments discussed here by way of example rather than limitation.

FIG. 1 is a schematic flowchart of implementation of a control method according to an embodiment of the application.

FIG. 2 is a schematic diagram of compositional structures of a clothes treatment device according to an embodiment of the application.

FIG. 3 is a schematic flowchart of another implementation of a control method according to an embodiment of the application.

FIG. 4 is a schematic flowchart of implementation of a control method of a light dry cleaning program according to an embodiment of the application.

FIG. 5 is a schematic diagram of compositional structures of a control apparatus according to an embodiment of the application.

FIG. 6 is a schematic diagram of compositional structures of a control device according to an embodiment of the application.

DETAILED DESCRIPTION

[0036] In order to make the purpose, technical solutions and advantages of the application clearer, the application will be described in further detail below with reference to the drawings. The described embodiments should not be considered as limitation to the application. All other embodiments obtained by those of ordinary skill in the art without paying any creative work fall within the scope of protection of the application.

[0037] In the following descriptions, reference is made to "some embodiments", which describe a subset of all possible embodiments; however, it may be understood that "some embodiments" may be the same subset or different subsets of all possible embodiments, and may be combined with each other without conflict.

[0038] In the following descriptions, reference is made to terms "first\second\third", which are only intended to distinguish similar objects, and do not represent a specific order for the objects. It may be understood that specific orders or sequences of "first\second\third" may be interchanged if allowable, to enable the embodiments of the application described here to be implemented in orders other than those illustrated or described here.

[0039] Unless stated otherwise, all technical and scientific terms used here have the same meaning as usually understood by technicians in the technical field to which the application belongs. The terms used here are only for the purpose of describing the embodiments of the application, and are not intended to limit the application.

[0040] Based on clothes treatment devices in related art, such as a dryer, a dishwasher, a dry cleaning machine, a washing-drying integrated machine, a clothes care machine, and other household appliances with air washing function, they have a single operation mode of air washing and cannot achieve flexible care, resulting in a problem of poor care effect. An embodiment of the

application provides a control method applied to a clothes treatment device. The method provided in the embodiment of the application may be implemented by a computer program, and when the computer program is executed, each operation of the control method provided in the embodiment of the application is completed. In some embodiments, the computer program may be executed by a processor in a control device. FIG. 1 is a schematic flowchart of implementation of a control method according to an embodiment of the application. As shown in FIG. 1, the control method includes the following operations S101 and S102.

[0041] At S101, it is determined whether a rotational speed of a tub body of a clothes treatment device reaches a first rotational speed.

[0042] The control method according to the embodiment of the application is applied to a household appliance with a steam generation apparatus, and the household appliance may be a clothes treatment device with steam function, such as a washing-drying integrated machine, a clothes dryer, a dry cleaning machine, a hanging ironing machine, a clothes care machine, etc.

[0043] A method of drying clothes in the related art is to introduce hot air into the tub body of the clothes treatment device, and use air with high temperature to dyr the clothes in the tub body. However, when air with high temperature is used, only the drying function may be achieved, and care effects such as wrinkle removal, deodorization, descaling and other care effects of the clothes are not apparent.

[0044] An embodiment of the application provides a clothes treatment device which achieves a clothes care function by using steam. FIG. 2 is a schematic diagram of compositional structures of a clothes treatment device according to an embodiment of the application. As shown in FIG. 2, the clothes treatment device 20 includes a tub body 21, a drying tunnel 22, a drying heater 23, a drying fan 24, a steam generation apparatus 25, and a condensate valve (not shown in the figure).

[0045] The tub body 21 includes an air outlet 211 and an air inlet 212. In some implementations, the tub body may include a water tub and a washing tub, and at this time, the air outlet 211 and the air inlet 212 are arranged on the water tub; in some implementations, the tub body includes a single tub, and at this time, the air outlet 211 and the air inlet 212 are arranged on the tub.

[0046] The drying tunnel 22 includes a drying tunnel inlet 221 and a drying tunnel outlet 222. The drying tunnel inlet 221 is communicated with the air outlet 211, and the drying tunnel outlet 222 is communicated with the air inlet 212, to form an air circulation channel. Gas in the drying tunnel enters the tub body 21 by passing through the drying tunnel outlet 222 and the air inlet 212 to contact processing objects (such as clothes) in the tub body 21, and then enters the drying tunnel by passing through the air outlet 211 and the drying tunnel inlet 221, thereby forming a cycle.

[0047] The drying heater 23 is arranged in the drying tunnel 22 and is configured to heat the gas flowing through the drying tunnel 22; the drying fan 24 is arranged between the drying tunnel inlet 221 and the drying heater 23; the steam generation apparatus 25 includes a steam outlet 251, and the steam outlet 251 is arranged between the drying tunnel inlet 221 and the drying fan 24. The steam generation apparatus here is a device which uses heat energy generated by the heater to vaporize water into steam.

[0048] The condensate valve is communicated with a condensate pipe (not shown in the figure) and the drying tunnel 22, to condense air passing through the drying tunnel 22.

[0049] In the embodiment of the application, the clothes treatment device with the steam generation apparatus is described by taking a dryer as an example. Unless specified otherwise, the clothes treatment device hereinafter refers to the dryer. In the embodiment of the application, when the dryer with the steam generation apparatus dries the clothes, an operation principle thereof is that a heating pipe in the steam generation apparatus is used to heat and vaporize water into steam with high temperature, and the steam with high temperature enters the drying tunnel from the steam outlet and enters the tub body of the dryer along the drying tunnel, to dry the clothes in the tub body. The steam with high temperature may also remove bacteria, odors, wrinkles or the like existed on the clothes while drying the clothes, to achieve care functions such as sterilization, deodorization, wrinkle removal, etc.

[0050] When a user requires care to be performed on the clothes, the user puts the clothes into the tub body of the dryer, and selects a drying program to perform a clothes treatment process. The tub body starts rotation, and the steam generation apparatus is turned on to generate steam. In the embodiment of the application, the user may perform control operations on a control panel of the clothes treatment device; or, may perform control operations through remote control, for example, remotely perform control operations on a terminal installed with a control program of the clothes treatment device, to control the clothes treatment device to start performing the clothes treatment process.

[0051] After the tub body starts rotation, the clothes in the tub body rotate in the tub body under an action of centrifugal force. When the rotational speed of the tub body is less than a critical rotational speed, the clothes in the tub body are in a state of suspending in the tub body, the steam enters the tub body from the air inlet of the tub body, and most of the steam is absorbed by the suspended clothes at the center of the tub body; when the rotational speed of the tub body is equal to or greater than the critical rotational speed, the clothes in the tub body are affixed to a tub wall of the tub body and are not present at the center of the tub body. At this time, only a small volume of the steam entering the tub body contacts the clothes affixed to the tub wall, and most of the steam may directly flow down from the center of the tub body

to the air outlet of the tub body, and may be discharged out of the tub body from the air outlet, thus resulting in waste. On the above basis, in the embodiment of the application, after the tub body starts rotation, the rotational speed of the tub body is detected to determine whether the rotational speed of the tub body reaches the first rotational speed. The first rotational speed is equal to or greater than the critical rotational speed, and the critical rotational speed is a minimum rotational speed by which the clothes in the tub body may be affixed to the tub wall of the tub body and rotate along with the tub body.

[0052] When it is detected that the rotational speed of the tub body reaches the first rotational speed, that is, the rotational speed of the tub body is equal to or greater than the first rotational speed, it is determined that the rotational speed of the tub body has reached the critical rotational speed, and the clothes in the tub body are affixed to the tub wall, the process proceeds to S102; When it is detected that the rotational speed of the tub body does not reach the first rotational speed, that is, the rotational speed of the tub body is less than the first rotational speed, it is considered that the rotational speed of the tub body is less than the critical rotational speed, and the clothes in the tub body are in a state of suspending in the tub body. At this time, the steam generation apparatus of the clothes treatment device is controlled to continue to generate steam, to perform clothes treatment on the clothes in the suspending state.

[0053] At S102, a steam generation apparatus of the clothes treatment device is controlled to stop generating steam.

[0054] When it is determined that the rotational speed of the tub body reaches the first rotational speed, the steam generation apparatus of the clothes treatment device is controlled to be turned off to stop generating steam. After the steam generation apparatus is turned off, steam is not generated any more, so that the steam introduced into the tub body is reduced, thereby reducing humidity of the clothes in the tub body and improving drying efficiency.

[0055] The control method provided in the embodiment of the application is applied to a clothes treatment device, and includes the following operations. It is determined that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and a steam generation apparatus of the clothes treatment device is controlled to stop generating steam. The first rotational speed is equal to or greater than a critical rotational speed. In this way, after the rotational speed of the tub body reaches the critical rotational speed, the clothes in the tub body are affixed to the tub wall and are not present at the center of the tub body. At this time, the steam generation apparatus is turned off to stop generating steam, which reduces energy consumption of the clothes treatment device and prevents the steam from passing through the center of the tub body without clothes, thus resulting in waste; furthermore, after generation of the steam is stopped, the steam introduced into the tub body is reduced, which may reduce humidity of the clothes in the tub body and improve clothes treatment efficiency.

[0056] In some embodiments, the above control method may further include the following operation S11 before S101 of the embodiment shown in FIG. 1.

[0057] At S11, it is determined that the clothes treatment device performs a clothes treatment process, and the clothes treatment device is controlled to operate in a third operation mode.

[0058] The third operation mode includes: turning on the steam generation apparatus, turning off a drying fan of the clothes treatment device, and turning off a drying heater of the clothes treatment device. When the clothes treatment device starts performing the clothes treatment process, the drying fan of the clothes treatment device is controlled to be turned off, the drying heater is turned off, and the steam generation apparatus is turned on to preheat the steam generation apparatus and the tub body.

[0059] In the embodiment of the application, when the clothes treatment device starts performing the clothes treatment process, the steam generation apparatus is controlled to be turned on. Temperature of the steam generation apparatus gradually increases. Before the temperature increases to a preset temperature upper limit threshold, water is not present in the steam generation apparatus and steam is not generated, which may prevent temperature of the steam generation apparatus from decreasing or increasing slowly due to vaporization and heat absorption. When temperature of the steam generation apparatus reaches the temperature upper limit threshold, water is introduced into the steam generation apparatus and is vaporized into steam through the steam generation apparatus with high temperature, thereby generating steam. The generated steam enters the drying tunnel through the steam outlet and enters the tub body along the drying tunnel, which may implement care functions such as dust removal, wrinkle removal, deodorization, sterilization and other care functions of the clothes in the tub body, and may effectively improve clothes shaping effect. In this way, temperature of the steam generation apparatus may quickly increase by preheating the steam generation apparatus, to prepare for subsequent usage of the steam generation apparatus, so as to ensure that a large volume of steam may be quickly introduced into the tub body when the steam generation apparatus is subsequently used to generate steam, to quickly increase temperature in the tub body and improve clothes care efficiency.

[0060] In some embodiments, the above control method may further include the following operation S12 after S11.

[0061] At S12, the tub body is controlled to operate at a second beat.

[0062] When the steam generation apparatus is preheated, the tub body may be controlled to operate continuously at a fourth rotational speed, or the tub body may

be controlled to operate indirectly at the fourth rotational speed and the second beat. The second beat includes a second rotation duration and a second stop duration, the tub body rotates at the fourth rotational speed for the second rotation duration, pauses for the second stop duration, and circulates operations in this way. Here, the second rotation duration is less than a rotation duration threshold, and the second stop duration is less than or equal to a stop duration threshold. In an actual application, the rotation duration threshold may be 20s (seconds), and the second rotation duration may be set as any value between 10s and 19s; the stop duration threshold may be 7s, and the second stop duration may be set as any value between 2s and 7s. For example, the second beat may take a value of 10s : 5s, 12s : 6s, etc.

[0063] In the embodiment of the application, when the steam generation apparatus is preheated, the tub body of the clothes treatment device is controlled to operate at the second beat, which may play a role of evenly and quickly dispersing the clothes in the tub body, and prevent the clothes in the tub body from tangling.

[0064] In some embodiments, the above control method may further include the following operation S13 after S11.

[0065] At S13, the clothes treatment device is controlled to operate in a first operation mode.

[0066] The first operation mode includes: turning off the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0067] In the embodiment of the application, S13 may be performed before S101, that is, after preheating of the steam generation apparatus of the clothes treatment device finishes, the clothes treatment device is controlled to operate in the first operation mode, the steam generation apparatus is turned off, the drying heater is started and then heats part of the steam generated in the preheating stage (accumulated in the drying tunnel), and the drying fan quickly introduces the heated steam into the tub body, so that the steam may quickly wrap the clothes; the drying heater reheats the steam to further increase temperature of the steam, so that moisture in the tub body may not be too large, while temperature in the tub may increase to achieve clothes ironing effect.

[0068] In the embodiment of the application, S13 may also be performed after S102. After the rotational speed of the tub body of the clothes treatment device reaches the first rotational speed, the clothes treatment device is controlled to operate in the first operation mode, the drying heater heats the gas flowing through the drying tunnel, and the drying fan quickly introduces the heated gas into the tub body, which may increase temperature in the tub body, maintain the gas in the tub body at a high temperature, and achieve the clothes ironing effect; furthermore, humidity brought by the steam may also be reduced, temperature and humidity in the tub are adjusted, thereby effectively improving the clothes care effect.

[0069] In some embodiments, the above control method further includes the following operation S14 after S11.

[0070] At S14, the clothes treatment device is controlled to operate in a second operation mode.

[0071] The second operation mode includes: turning on the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0072] In the embodiment of the application, S14 may be performed before S101, that is, before the rotational speed of the tub body reaches the first rotational speed, the clothes treatment device is controlled to operate in the second operation mode; S14 may also be performed after S13, that is, after the clothes treatment device operates in the first operation mode for a certain period of time, the clothes treatment device is controlled to operate in the second operation mode.

[0073] In the embodiment of the application, the clothes treatment device operates in the second operation mode, the steam generation apparatus is turned on to generate steam, the steam enters the drying tunnel through the steam outlet and is heated by the drying heater to form superheated steam, and the drying fan promotes the superheated steam to enter the tub body. Since the steam generation apparatus is preheated, steam may be generated immediately when the steam generation apparatus is started again, so that a large volume of steam may be quickly introduced into the tub body, which may quickly increase temperature in the tub body and improve the clothes care efficiency. The steam generated by the steam generation apparatus may implement care functions such as dust removal, wrinkle removal, deodorization, sterilization and other care functions of the clothes in the tub body, which may effectively improve the clothes shaping effect. Furthermore, the drying heater reheats steam in the drying tunnel, and the generated superheated steam may increase temperature in the tub while adjust temperature and humidity in the tub. The superheated steam is quickly introduced into the tub body by the drying fan, so that the steam may quickly and evenly contact the clothes, and the gas in the tub body is maintained at a high temperature to prevent condensation of the steam, thereby reducing humidity in the tub body, ensuring that the clothes may not be wetted, and effectively improving the clothes care effect.

[0074] In some embodiments, when the clothes treatment device operates in the first operation mode or the second operation mode, rotation of the tub body of the clothes treatment device may be controlled at the same time. The above control method may further include the following operation S15 after S13 or S14.

[0075] At S15, the tub body is controlled to operate at a second rotational speed.

[0076] After the tub body operates at the second rotational speed for a certain period of time, the process proceeds to S16, and the tub body continues to operate at a third rotational speed.

[0077] In the embodiment of the application, the second rotational speed is less than the critical rotational

speed, and when the tub body operates at the second rotational speed, the clothes in the tub body are not affixed to the tub wall and are suspended and rotate in the tub body under an action of centrifugal force, which may play a role of throwing, dispersing and stretching the clothes, to help to remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with steam or hot air in case that the clothes are stretched, to improve clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0078] At S16, the tub body is controlled to operate at a third rotational speed.

[0079] The third rotational speed is equal to or greater than the second rotational speed, and both the second rotational speed and the third rotational speed are less than the critical rotational speed.

[0080] Here, the tub body operating at the second rotational speed may mean that the tub body operates continuously at the second rotational speed. Similarly, the tub body operating at the third rotational speed may mean that the tub body operates continuously at the third rotational speed. The second rotational speed may be any value between 30 rpm (revolution per minute) and 60 rpm; the third rotational speed may be any value between 30 rpm and 70 rpm which is equal to or greater than the second rotational speed. For example, the second rotational speed is 50 rpm, the third rotational speed is 60 rpm.

[0081] In the embodiment of the application, the third rotational speed is equal to or greater than the second rotational speed and is less than the critical rotational speed. When the tub body operates at the third rotational speed, the rotational speed is increased, and the clothes in the tub body are close to the tub wall and suspended and rotate in the tub body, which may further play a role of throwing, dispersing and stretching the clothes, to help to further remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with steam or hot air in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0082] At S 17, it is determined that a duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration.

[0083] The tub body may operate at the second rotational speed for a first duration, and then operate at the third rotational speed. When a sum of the first duration and a duration for operating at the third rotational speed reaches the preset duration, it is considered that the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration, and the process proceeds to S18 at this time; when the sum of the first duration and the duration for operating at the third rotational speed is less than the preset duration, it is considered that the duration for the tub body operating at the second rotational speed and the third rotational speed does not reach the preset duration, and S16 is continued at this time.

[0084] Here, the preset duration may be any value between 100s and 200s, such as 168s. The first duration may be any value less than the preset duration, for example, the first duration is 56s. Then, when the duration for the tub body operating at the third rotational speed reaches 112s, the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration.

[0085] S18, the tub body is controlled to operate at the first rotational speed.

[0086] During operation of the tub body at the second rotational speed and the third rotational speed, the clothes are suspended and rotate in the tub body, and most of the steam may wrap the clothes or may be sprayed on the clothes. When the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration, a volume of steam introduced during the preset duration is neither more nor less, so that moisture in the tub is neither too wet nor too dry. Then, the tub body is controlled to operate at the first rotational speed, the first rotational speed is greater than the third rotational speed and greater than the critical rotational speed. At this time, the clothes in the tub body are affixed to the tub wall and rotate along with the tub body, which may play a role of fully throwing, dispersing and stretching the clothes, so that the clothes are fully stretched and spread on the tub wall, which helps to further remove wrinkles on the clothes and further improve wrinkle removal effect.

[0087] Here, the first rotational speed may be any value greater than the critical rotational speed. For example, when the critical rotational speed is 80 rpm, the first rotational speed may be set as any value greater than 80 rpm. In an actual application, the higher the rotational speed of the tub body, the longer it takes for the tub body to stop, and the higher the rotational speed, the higher the requirements for the tub body and motor, and the higher the cost of the clothes treatment device. Based on the above factors, the first rotational speed may be set as a value slightly greater than the critical rotational speed, for example, the first rotational speed may be set as 81 rpm, 85 rpm or other values, to ensure that the clothes in the tub body may be affixed to the tub wall and rotate along with the tub wall.

[0088] In the above embodiment, during rotation of the tub body at the first rotational speed, the second rotational speed and the third rotational speed, the tub body may be controlled to operate continuously or intermittently. In order to control the intermittent operation of the tub body, it may be implemented as the following operation S21.

[0089] At S21, the tub body is controlled to operate at a first beat.

[0090] The first beat includes a first rotation duration and a first stop duration, the first rotation duration is equal to or greater than the rotation duration threshold, the first

stop duration is less than or equal to the stop duration threshold, and the first beat is stronger than the second beat. When the tub body just starts rotation, the tub body is controlled to operate at the second beat, which may evenly and quickly disperse the clothes in the tub body, to prevent the clothes in the tub body from tangling. After rotating for a period of time, operation beat of the tub body is increased, so that when the tub body rotates, the clothes rotate in the tub body; after the tub body stops rotation, the clothes fall back to the bottom of the tub body under an action of gravity. The process circulates in this way, which may achieve throwing and dispersing the clothes for many times, and stretching and spreading each part of the clothes, to help to further remove wrinkles on the clothes and further improve the wrinkle removal effect.

[0091] In the embodiment of the application, when the tub body operates at the first rotational speed, it may mean that the tub body may operate intermittently at the first rotational speed and the first beat, that is, the tub body operates at the first rotational speed for the first rotation duration P_1s and then pauses for the first stop duration Q_1s, and then continues to operate with this regularity, P_1 and Q_1 are positive integers. When the tub body operates at the second rotational speed, it may mean that the tub body may operate intermittently at the second rotational speed and the first beat, that is, the tub body operates at the second rotational speed for the first rotation duration P_2s and then pauses for the first stop duration Q_2s, and then continues to operate with this regularity, P_2 and Q_2 are positive integers. When the tub body operates at the third rotational speed, it may mean that the tub body may operate intermittently at the third rotational speed and the first beat, that is, the tub body operates at the third rotational speed for the first rotation duration P_3s and then pauses for the first stop duration Q_3s, and then continues to operate with this regularity, P_3 and Q_3 are positive integers.

[0092] Under an action of inertia, the greater the rotational speed of the tub body, the greater the rotational speed of the clothes in the tub body, and the longer it takes for the clothes in the tub body to stop after the tub body stops. Therefore, the greater the rotational speed of the tub body, the longer the first stop time. In the embodiment of the application, when the tub body operates at the first rotational speed, the second rotational speed and the third rotational speed respectively, the corresponding first beat P_1: Q_1, P_2: Q_2 and P_3: Q_3 may be the same or different. In an actual application, the rotation duration threshold may be 5s, the first rotation duration may take any value between 5s and 40s; the stop duration threshold may be any value between 1s and 20s, for example, the first stop duration may take a value of 1s, 2s, 3s, 5s, 7s, etc. For example, the first beat may take a value of 21s : 5s, 21s : 3s, 25s : 5s, 25s : 3s, 27s : 5s, 27s : 3s, etc. In the embodiment of the application, the first rotation duration is set as a long-time value, and the first stop duration is set as a short-time value, which may shorten clothes treatment duration and improve the clothes treatment efficiency.

[0093] In some embodiments, after the drying process finishes, cooling process of the clothes in the tub body may be continued, and the cooling process may be implemented by the following operation S 103.

[0094] At S103, the clothes treatment device is controlled to operate in a fourth operation mode.

[0095] The fourth operation mode includes: turning off the drying heater, turning on the drying fan, and turning off the steam generation apparatus.

[0096] In processes of drying and dehumidifying the clothes, temperature in the tub body is high due to introduction of the steam with high temperature or introduction of the gas with high temperature heated by the drying heater. At this time, when a door of the clothes treatment device is directly opened, the run-out hot air or clothes with high temperature may cause damage to the user. On the above basis, after dehumidification finishes, the drying heater is turned off to stop continuing to heat air in the tub body; furthermore, the drying fan is kept to be turned on, to blow air to the clothes with high temperature, thereby reducing temperature of the clothes.

[0097] In some embodiments, the fourth operation mode further includes turning on a condensate valve of the clothes treatment device.

[0098] In order to reduce temperature in the tub body faster, the condensate valve is controlled to be turned on while the drying fan is turned on, to use the condensate valve to cool hot air in the drying tunnel so as to generate cold air, and then use the drying fan to quickly introduce the cold air into the tub body, which may quickly reduce temperature in the tub body and shorten clothes cooling time.

[0099] When temperature of the clothes in the tub body is less than or equal to a preset temperature threshold, or when it is determined that an ON duration of the condensate valve reaches a preset duration threshold, it is considered that temperature in the tub body is reduced to a low temperature, and when the door of the clothes treatment device is opened at this time, hot steam may not run out, and temperature of the clothes in the tub body may not damage the user. At this time, it is determined that cooling is over, and the clothes treatment device is controlled to finish operations.

[0100] Based on the embodiment shown in FIG. 1, an embodiment of the application further provides a control method, and FIG. 3 is a schematic flowchart of another implementation of a control method according to an embodiment of the application. As shown in FIG. 3, the control method includes the following operations S301 to S316.

[0101] At S301, it is determined that a clothes treatment device performs a clothes treatment process, and the clothes treatment device is controlled to operate in a third operation mode.

[0102] The third operation mode includes: turning on the steam generation apparatus, turning off a drying fan

of the clothes treatment device, and turning off a drying heater of the clothes treatment device. When the clothes treatment device starts performing the clothes treatment process, the drying fan of the clothes treatment device is controlled to be turned off, the drying heater is turned off, and the steam generation apparatus is turned on to preheat the steam generation apparatus.

[0103] Temperature of the steam generation apparatus may quickly increase by preheating the steam generation apparatus, to prepare for subsequent usage of the steam generation apparatus, so as to ensure that a large volume of steam may be quickly introduced into the tub body when the steam generation apparatus is subsequently used to generate steam, to quickly increase temperature in the tub body and improve the clothes care efficiency.

[0104] At S302, a tub body of the clothes treatment device is controlled to operate at a fourth rotational speed and a second beat.

[0105] Here, the second beat includes a second rotation duration and a second stop duration, the second rotation duration is less than the rotation duration threshold, and the second stop duration is less than or equal to the stop duration threshold. The tub body operates at the fourth rotational speed and the second beat, that is, the tub body operates at the fourth rotational speed for the second rotation duration, pauses for the second stop duration, and circulates operations in this way.

[0106] Here, the fourth rotational speed may be any value between 30 rpm and 60 rpm, for example, the fourth rotational speed may be set as 50 rpm; the rotation duration threshold may be set as 20s, the stop duration threshold may be set as 7s, and the second beat may be set as a value of 10s : 5s, 12s : 6s, etc.

[0107] In the embodiment of the application, when the steam generation apparatus is preheated, the tub body of the clothes treatment device is controlled to operate at the second beat, which may play a role of evenly and quickly dispersing the clothes in the tub body, and prevent the clothes in the tub body from tangling.

[0108] At S303, the clothes treatment device is controlled to operate in a first operation mode.

[0109] The first operation mode includes: turning off the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0110] After preheating of the steam generation apparatus of the clothes treatment device finishes, the clothes treatment device is controlled to operate in the first operation mode, the steam generation apparatus is turned off, the drying heater is started and then heats part of the steam generated in the preheating stage (accumulated in the drying tunnel), and the drying fan quickly introduces the heated steam into the tub body, so that the steam may quickly wrap the clothes; the drying heater reheats the steam to further increase temperature of the steam, so that moisture in the tub body may not be too large, while temperature in the tub may increase to achieve the clothes ironing effect.

[0111] At S304, the tub body is controlled to operate at a second rotational speed and a first beat.

[0112] Here, the first beat includes a first rotation duration and a first stop duration, the first rotation duration is equal to or greater than the rotation duration threshold, and the first stop duration is less than or equal to the stop duration threshold. The tub body operates at the second rotational speed and the first beat, that is, the tub body operates at the second rotational speed for the first rotation duration, pauses for the first stop duration, and circulates operations in this way.

[0113] Here, the second rotational speed may be any value between 30 rpm and 60 rpm, for example, the second rotational speed may be set as 50 rpm; the rotation duration threshold may be set as 5s, the stop duration threshold may be set as any value between 1s and 20s, for example, the first stop duration may take a value of 1s, 2s, 3s, 5s, 7s or the like, and the first beat may be set as a value of 27s : 3s, 25s : 3s, etc.

[0114] In the embodiment of the application, the second rotational speed is less than the critical rotational speed, and the critical rotational speed is a minimum rotational speed by which the clothes in the tub body may be affixed to the tub wall of the tub body and rotate along with the tub body. The critical rotational speed may take a value of 80 rpm.

[0115] In the embodiment of the application, when the tub body operates at the second rotational speed, the clothes in the tub body are not affixed to the tub wall and are suspended and rotate in the tub body under an action of centrifugal force, which may play a role of throwing, dispersing and stretching the clothes, to help to remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with hot air in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0116] After the tub body operates at the second rotational speed and the first beat for the first duration, the process proceeds to S305.

[0117] At S305, the tub body is controlled to operate at a third rotational speed and the first beat.

[0118] The third rotational speed is equal to or greater than the second rotational speed, and both the second rotational speed and the third rotational speed are less than the critical rotational speed. Here, the tub body operates at the third rotational speed and the first beat, that is, the tub body operates at the third rotational speed for the first rotation duration, pauses for the first stop duration, and circulates operations in this way.

[0119] Here, the third rotational speed may be any value between 30 rpm and 70 rpm, for example, the third rotational speed may be set as 60 rpm or 65 rpm; the rotation duration threshold may be set as 5s, the stop duration threshold may be any value between 1s and 20s, for example, the first stop duration may take a value of 1s, 2s, 3s, 5s, 7s or the like, and the first beat may be

set as a value of 27s : 3s, 25s : 3s, etc.

[0120] In the embodiment of the application, the third rotational speed is equal to or greater than the second rotational speed and is less than the critical rotational speed. When the tub body operates at the third rotational speed, the rotational speed is increased, and the clothes in the tub body are close to the tub wall and suspended and rotate in the tub body, which may further play a role of throwing, dispersing and stretching the clothes, to help to further remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with hot air in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0121] At S306, it is determined whether a duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration.

[0122] The tub body may operate at the second rotational speed for the first duration, and then operate at the third rotational speed. When a sum of the first duration and a duration for operating at the third rotational speed reaches the preset duration, it is considered that the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration, and the process proceeds to S307 at this time; when the sum of the first duration and the duration for operating at the third rotational speed is less than the preset duration, it is considered that the duration for the tub body operating at the second rotational speed and the third rotational speed does not reach the preset duration, and S305 is continued at this time.

[0123] Here, the preset duration may be any value between 100s and 200s, such as 168s. The first duration may be any value less than the preset duration, for example, the first duration is 56s. Then, when the duration for the tub body operating at the third rotational speed reaches 112s, the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration.

[0124] At S307, the tub body is controlled to operate at a first rotational speed and the first beat.

[0125] The first rotational speed is equal to or greater than the critical rotational speed. Here, the tub body operates at the first rotational speed and the first beat, that is, the tub body operates at the first rotational speed for the first rotation duration, pauses for the first stop duration, and circulates operations in this way.

[0126] Here, the first rotational speed may be any value equal to or greater than the critical rotational speed, for example, when the critical rotational speed is 80 rpm, the first rotational speed is set as 81 rpm; the rotation duration threshold may be set as 5s, the stop duration threshold may be any value between 1s and 20s, for example, the first stop duration may take a value of 1s, 2s, 3s, 5s, 7s or the like, and the first beat may be set as a value of 27s : 3s, 25s : 3s, etc.

[0127] In the embodiment of the application, the first rotational speed is equal to or greater than the critical rotational speed. When the tub body operates at the first rotational speed, the clothes in the tub body are affixed to the tub wall and rotate along with the tub body, which may play a role of fully throwing, dispersing and stretching the clothes, so that the clothes are fully stretched and spread on the tub wall, which helps to further remove wrinkles on the clothes and further improve the wrinkle removal effect.

[0128] After the tub body operates at the first rotational speed and the first beat for a second duration, the process proceeds to S308. Here, the second duration may take any value between 50s and 200s, for example, take a value of 60s.

[0129] At S308, the clothes treatment device is controlled to operate in a second operation mode.

[0130] The second operation mode includes: turning on the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0131] When the clothes treatment device operates in the first operation mode, the steam generation apparatus is turned off, and after the tub body operates at the first rotational speed and the first beat for the second duration, the steam generation apparatus is controlled to be turned on, to control the clothes treatment device to operate in the second operation mode.

[0132] In the embodiment of the application, the clothes treatment device operates in the second operation mode, the steam generation apparatus is turned on to generate steam, the steam enters the drying tunnel through the steam outlet and is heated by the drying heater to form superheated steam, and the drying fan promotes the superheated steam to enter the tub body. Since the steam generation apparatus is preheated, steam may be generated immediately when the steam generation apparatus is started again, so that a large volume of steam may be quickly introduced into the tub body, which may quickly increase temperature in the tub body and improve the clothes care efficiency. The steam generated by the steam generation apparatus may implement care functions such as dust removal, wrinkle removal, deodorization, sterilization and other care functions of the clothes in the tub body, which may effectively improve the clothes shaping effect. Furthermore, the drying heater reheats steam in the drying tunnel, and the generated superheated steam may increase temperature in the tub while adjust temperature and humidity in the tub. The superheated steam is quickly introduced into the tub body by the drying fan, so that the steam may quickly and evenly contact the clothes, and the gas in the tub body is maintained at a high temperature to prevent condensation of the steam, thereby reducing humidity in the tub body, ensuring that the clothes may not be wetted, and effectively improving the clothes care effect.

[0133] At S309, the tub body is controlled to operate at the second rotational speed and the first beat.

[0134] Here, implementations of S309 to S311 refer to descriptions of S304 to S306 respectively. Difference be-

tween S309 to S311 and S304 to S306 lies in that when S304 to S306 are performed, the steam generation apparatus is in an OFF state and stops generating steam, so that the heated air enters the tub body; and when S309 to S311 are performed, the steam generation apparatus is in an ON state and generates steam, so that the superheated steam enters the tub body.

[0135] In the embodiment of the application, when the tub body operates at the second rotational speed, the clothes in the tub body are not affixed to the tub wall and are suspended and rotate in the tub body under an action of centrifugal force, which may play a role of throwing, dispersing and stretching the clothes, to help to remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with steam or hot air in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0136] At S310, the tub body is controlled to operate at the third rotational speed and the first beat.

[0137] In the embodiment of the application, when the tub body operates at the third rotational speed, the rotational speed is increased, and the clothes in the tub body are close to the tub wall and suspended and rotate in the tub body, which may further play a role of throwing, dispersing and stretching the clothes, to help to further remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with steam in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects.

[0138] At S311, it is determined whether a duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration.

[0139] When the duration for the tub body operating at the second rotational speed and the third rotational speed reaches the preset duration, the process proceeds to S312 at this time; when the duration for the tub body operating at the second rotational speed and the third rotational speed does not reach the preset duration, S311 is continued at this time.

[0140] At S312, the tub body is controlled to operate at the first rotational speed and the first beat.

[0141] At S313, the clothes treatment device is controlled to operate in the first operation mode.

[0142] The first operation mode includes: turning off the steam generation apparatus, turning on the drying fan of the clothes treatment device, and turning on the drying heater of the clothes treatment device.

[0143] Here, S312 and S313 may be performed simultaneously. When the clothes treatment device operates in the second operation mode, the steam generation apparatus is turned on, and when the rotational speed of the tub body reaches the first rotational speed, the steam generation apparatus is controlled to be turned off to stop generating steam at this time, so that the steam introduced into the tub body is reduced, thereby reducing humidity of the clothes in the tub body and improving the drying efficiency.

[0144] In the embodiment of the application, the first rotational speed is equal to or greater than the critical rotational speed. When the tub body operates at the first rotational speed, the clothes in the tub body are affixed to the tub wall and rotate along with the tub body, which may play a role of fully throwing, dispersing and stretching the clothes, so that the clothes are fully stretched and spread on the tub wall, which helps to further remove wrinkles on the clothes and further improve the wrinkle removal effect; since the clothes in the tub body are affixed to the tub wall and are not present at the center of the tub body, the steam generation apparatus is turned off to stop generating steam at this time, which reduces energy consumption of the clothes treatment device and prevents the steam from passing through the center of the tub body without clothes, thus resulting in waste; furthermore, after generation of the steam is stopped, the steam introduced into the tub body is reduced, which may reduce humidity of the clothes in the tub body and improve the clothes treatment efficiency.

[0145] After the tub body operates at the first rotational speed and the first beat for the second duration, that is, after the steam generation apparatus is turned off for the second duration, that is, after the clothes treatment device operates in the first operation mode for the second duration, the process proceeds to S314.

[0146] At S314, it is determined whether a number of times for the clothes treatment device operating alternately in the first operation mode and the second operation mode reaches a predetermined number of times.

[0147] According to the method provided in the embodiment of the application, when the clothes treatment device operates in the first operation mode, the steam generation apparatus does not generate steam; when the clothes treatment device operates in the second operation mode, the steam generation apparatus generates steam. These operations are circulated in this way for many times, therefore not only the steam evenly contacts the clothes to further improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects, but also air pressure in the tub body may be maintained within a normal range by repeatedly turning on and off the steam generation apparatus, to prevent air leakage caused by excessive air pressure in the tub body; furthermore, the drying heater is always turned on, so that the superheated steam is introduced into the tub body, which may prevent the steam from wetting the clothes in the tub body, and ensure the clothes care effect.

[0148] When the number of times for the clothes treatment device operating alternately in the first operation mode and the second operation mode reaches the predetermined number of times, that is, a number of times for turning on and off the steam generation apparatus alternately reaches a predetermined number of times, the process proceeds to S315; when the number of times for the clothes treatment device operating alternately in

the first operation mode and the second operation mode does not reach the predetermined number of times, the process returns to S308 to continue to operate alternately in the first operation mode and the second operation mode. The predetermined number of times here may be determined according to materials of the clothes. In case of easy-to-process clothes (such as clothes made of silk materials which are easy to dry), the predetermined number of times is set to a small value, such as 1 or 2; in case of difficult-to-process clothes (such as clothes made of cotton materials which are difficult to dry), the predetermined number of times is set to a large value, such as 4 or 5.

[0149] In some other embodiments, it may be determined whether the alternate operation finishes according to a duration when the clothes treatment device operates alternately in the first operation mode and the second operation mode, and at this time, S314 may be replaced by the following operation S314'.

[0150] At S314', it is determined whether a duration when the clothes treatment device operates alternately in the first operation mode and the second operation mode reaches a predetermined duration.

[0151] When it is determined that the duration when the clothes treatment device operates alternately in the first operation mode and the second operation mode reaches the predetermined duration, the process proceeds to S315; when the duration when the clothes treatment device operates alternately in the first operation mode and the second operation mode does not reach the predetermined duration, the process returns to S308 to continue to operate alternately in the first operation mode and the second operation mode. The predetermined duration here may be determined according to materials of the clothes. In case of easy-to-process clothes (such as clothes made of silk materials which are easy to dry), the predetermined duration is set to a small value, such as 10 min (minutes); in case of difficult-to-process clothes (such as clothes made of cotton materials which are difficult to dry), the predetermined duration is set to a large value, such as 15 min.

[0152] At S315, the clothes treatment device is controlled to operate in the first operation mode.

[0153] After the clothes treatment device operating alternately in the first operation mode and the second operation mode finishes, the drying heater is controlled again to heat the gas in the drying tunnel, and hot air circulation further reduces moisture of the tub body and humidity of the clothes, to achieve dehumidification processing; furthermore, temperature in the tub may increase to further optimize the clothes ironing effect, thereby improving the clothes care effect.

[0154] At S316, the clothes treatment device is controlled to operate in a fourth operation mode.

[0155] The fourth operation mode includes: turning off the drying heater, turning on the drying fan, turning off the steam generation apparatus, and turning on the condensate valve of the clothes treatment device.

[0156] In processes of drying and dehumidifying the clothes, temperature in the tub body is high due to introduction of the steam with high temperature or introduction of the gas with high temperature heated by the drying heater. At this time, when the door of the clothes treatment device is directly opened, the run-out hot air or clothes with high temperature may cause damage to the user. On the above basis, after dehumidification finishes at S315, the drying heater is turned off to stop continuing to heat air in the tub body; furthermore, the condensate valve is controlled to be turned on while the drying fan is kept to be turned on, to use the condensate valve to cool hot air in the drying tunnel so as to generate cold air, and then use the drying fan to quickly introduce the cold air into the tub body, which may quickly reduce temperature in the tub body and shorten the clothes cooling time.

[0157] In the embodiment of the application, it is determined that the clothes treatment device performs the clothes treatment process, the clothes treatment device is controlled to operate in the third operation mode, and the steam generation apparatus is preheated, which may quickly increase temperature of the steam generation apparatus; When the steam generation apparatus is preheated, the tub body of the clothes treatment device is controlled to operate at the second beat, which may play a role of evenly and quickly dispersing the clothes in the tub body, and prevent the clothes in the tub body from tangling. After preheating finishes, the clothes processing device is controlled to operate alternately in the first operation mode and the second operation mode, not only the steam evenly contacts the clothes to further improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects, but also air pressure in the tub body may be maintained within a normal range by repeatedly turning on and off the steam generation apparatus, to prevent air leakage caused by excessive air pressure in the tub body; furthermore, the drying heater is always turned on, so that the superheated steam is introduced into the tub body, which may prevent the steam from wetting the clothes in the tub body, and ensure the clothes care effect. Each time the clothes treatment device operates in the first operation mode or the second operation mode, the tub body is controlled to operate at the second rotational speed and then operate at the third rotational speed, while the tub body is controlled to operate at the first beat, the clothes in the tub body are not affixed to the tub wall and are suspended and rotate in the tub body under an action of centrifugal force, which may play a role of throwing, dispersing and stretching the clothes for many times, to help to remove wrinkles on the clothes; furthermore, the clothes may uniformly contact with hot air in case that the clothes are stretched, to improve the clothes care effects such as dust removal, wrinkle removal, deodorization, sterilization and other clothes care effects; finally, the tub body is controlled to operate at the first rotational speed and the first beat, the clothes in the tub body are affixed to the tub wall and rotate along

with the tub body, which may play a role of fully throwing, dispersing and stretching the clothes for many times, so that the clothes are fully stretched and spread on the tub wall, which helps to further remove wrinkles on the clothes and further improve the wrinkle removal effect. After the clothes treatment device operating alternately in the first operation mode and the second operation mode finishes, the clothes treatment device is controlled to operate in the first operation mode again, which may further reduce moisture of the tub body and humidity of the clothes, to achieve dehumidification processing; furthermore, temperature in the tub may increase to further optimize the clothes ironing effect, thereby improving the clothes care effect. Finally, the clothes treatment device is controlled to operate in the fourth operation mode, which may quickly reduce temperature in the tub body and shorten the clothes cooling time.

[0158] An exemplary application of the embodiment of the application in an actual application scenario will be described below.

[0159] At present, air washing is implemented by hot air circulation or spraying some atomized water, which has poor clothes care effects, and cannot achieve real ironing and other care effects. Moreover, beat of air washing is relatively simple, and the same beat is used in different types of fabrics, which cannot achieve real customized care.

[0160] In view of the problem existed in the related art, an embodiment of the application provides a control method of a light dry cleaning program. FIG. 4 is a schematic flowchart of implementation of a control method of a light dry cleaning program according to an embodiment of the application. As shown in FIG. 4, the method includes the following operations S401 to S407.

[0161] At S401, the program starts.

[0162] At S402, a steam generator is turned on for 2.5 min, the drying fan is turned off, and the drying heater is turned off; a rotation-to-stop ratio of the tub body is 10s/5s, and the rotational speed of the tub body is 50 rpm.

[0163] Here, the steam generator (corresponding to the above steam generation apparatus) is turned on for about 2.5 min in advance, which may preheat the steam generator to generate a sufficient volume of steam to be introduced into the tub; the tub body rotates at 50 rpm and a 10/5 beat, which plays a role of evenly dispersing the clothes.

[0164] In the embodiment of the application, the steam generator is turned on in advance in a start-up stage of the program, and efficiency of the steam generator may be improved after it is preheated.

[0165] At S403, the steam generator is turned off, the drying fan is turned on, and the drying heater is turned on; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s; and the rotation-to-stop ratio of the tub body is 25s/5s, the rotational speed is maintained at 80 rpm for 1 min.

[0166] After the drying fan is turned on, the steam is blown into the tub, and the drying heater is turned on to reheat the steam, to reduce humidity of the steam and prevent wetting the clothes; the beat increases to 25/3, to fully beat the clothes; the rotational speed increases from 50 rpm to 60 rpm slowly, to make the clothes fully stretched in the tub, and the rotational speed increases to 80 rpm subsequently, and the clothes are close to a state of affixing to the tub, which improves the clothes shaping effect more effectively.

[0167] At S404, the steam generator is turned on, the drying fan is turned on, and the drying heater is turned on; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s.

[0168] At S405, the steam generator is turned off, the drying fan is turned on, and the drying heater is turned on; the rotation-to-stop ratio of the tub body is 25s/5s, the rotational speed is maintained at 80 rpm for 1 min (circulating twice according to the above beat).

[0169] S404 and S405 are performed two times cyclically, and then the program proceeds to S406. During execution of the program, the steam generator is turned on and off repeatedly to achieve intermittent steam introduction, which may play a role of adjusting humidity and temperature in the tub, while achieve functions such as dust removal, wrinkle removal, deodorization, sterilization and other functions, to prevent introduction of excessive steam to wet the clothes or induce excessive pressure in the tub, thus resulting in air leakage.

[0170] At S406, the steam generator is turned off, the drying fan is turned on, and the drying heater is turned on; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s.

[0171] Before the program finishes, the steam generator is turned off, and hot air circulation reduces humidity in the tub, to prevent problems such as excessive humidity in the clothes, or steam running out after opening the door, etc.

[0172] At S407, it is a cooling stage: the steam generator is turned off, the drying fan is turned on, the drying heater is turned off, and condensate water is turned on in the whole stage; the rotation-to-stop ratio of the tub body is 12s/3s, the rotational speed is maintained at 50 rpm for 3 min; and the rotation-to-stop ratio of the tub body is 25s/5s, the rotational speed is maintained at 80 rpm for 1 min (operating alternately until the end of cooling).

[0173] Condensate water is turned on in the whole cooling stage, to rapidly cool down and shorten time of the program.

[0174] In the embodiments of the application, with respect to different types of fabrics, the rotational speed and the beat may be set as different values, which may achieve targeted care for various materials. For example, in case of conventional fabrics, the beat is set as 50 rpm, 60 rpm, 80 rpm, 50 rpm and 60 rpm, which may play a role of fully throwing, dispersing and stretching the fab-

rics, a state of affixing to the tub body at 80 rpm may make the fabrics fully stretched and spread on the tub wall; in case of fine fabrics, the beat is set as 30 rpm, 50rpm. In general, the fine fabrics are prevented from contacting with the tub wall, since the fabrics may be scratched by holes in the tub wall. Therefore, softer beats of 30 rpm and 50 rpm are used to keep the fabrics in a semisuspended state in the tub, reducing contact and friction of the fabrics with the tub wall.

[0175] By controlling the ON duration and beat of the steam generator as well as the rotational speed and beat of the washing tub, temperature and humidity in the tub may be accurately controlled, and care may be customized for fabrics made of different materials, to achieve fine care for different types of fabrics. According to the method provided in the embodiment of the application, the steam generator is turned on intermittently during execution of the program, which may control temperature and humidity in the tub; washing beat and rotational speeds are different with respect to different types of fabrics, to achieve an effect of targeted clothes care; hot air is introduced before cooling down according to the program, which may reduce humidity in the tub, ensure that dried clothes are obtained, and improve the clothes care effect.

[0176] Descriptions of an exemplary structure of a control apparatus provided in an embodiment of the application implemented as a software module are continued below. FIG. 5 is a schematic diagram of compositional structures of a control apparatus according to an embodiment of the application, the control apparatus is applied to the clothes treatment device shown in FIG. 2. As shown in FIG. 5, software modules in the control apparatus 500 may include a first control module 501.

[0177] The first control module 501 is configured to determine that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and control a steam generation apparatus of the clothes treatment device to stop generating steam. The first rotational speed is equal to or greater than a critical rotational speed.

[0178] In some embodiments, the control apparatus 500 may further include a second control module.

[0179] The second control module is configured to control the clothes treatment device to operate in a first operation mode.

[0180] The first operation mode includes: turning off the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0181] In some embodiments, the second control module is further configured to control the clothes treatment device to operate in a second operation mode. The second operation mode includes: turning on the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

[0182] In some embodiments, the control apparatus 500 may further include a third control module.

[0183] The third control module is configured to control the tub body to operate at a second rotational speed and then operate at a third rotational speed. The third rotational speed is equal to or greater than the second rotational speed, and both the second rotational speed and the third rotational speed are less than the critical rotational speed.

[0184] In some embodiments, the third control module is further configured to determine that a duration when the tub body operates at the second rotational speed and the third rotational speed reaches a preset duration, and control the tub body to operate at the first rotational speed.

[0185] In some embodiments, the third control module is further configured to control the tub body to operate at a first beat. The first beat includes a first rotation duration and a first stop duration, the first rotation duration is equal to or greater than a rotation duration threshold, and the first stop duration is less than or equal to a stop duration threshold.

[0186] In some embodiments, the second control module is further configured to control the clothes treatment device to operate in a third operation mode. The third operation mode includes: turning on the steam generation apparatus, turning off a drying fan of the clothes treatment device, and turning off a drying heater of the clothes treatment device.

[0187] In some embodiments, the third control module is further configured to control the tub body to operate at a second beat. The second beat includes a second rotation duration and a second stop duration, the second rotation duration is less than the rotation duration threshold, the second stop duration is less than or equal to the stop duration threshold, and the second beat is weaker than the first beat.

[0188] It should be pointed out here that the above descriptions of the embodiments of the control apparatus are similar to the above descriptions of the method, and have the same advantageous effects as the method embodiments. Technical details which are not disclosed in the embodiments of the control apparatus of the application, may be understood by those skilled in the art with reference to the descriptions of the method embodiments of the application.

[0189] An embodiment of the application further provides a control device, the control device is applied to the clothes treatment device shown in FIG. 2. FIG. 6 is a schematic diagram of compositional structures of a control device according to an embodiment of the application. According to an exemplary structure of the control device 600 shown in FIG. 6, other exemplary structures of the control device 600 may be expected. Therefore, the structure described here should not be considered as limitation, for example, part of components described below may be omitted, or components which are not described below may be added to adapt to special requirements of certain applications.

[0190] The control device 600 shown in FIG. 6 includes a processor 601, at least one communication bus 602, a user interface 603, at least one external communication interface 604 and a memory 605. The communication bus 602 is configured to implement connection and communication between these components. The user interface 603 may include a display panel 6031, and the external communication interface 604 may include a standard wired interface and a wireless interface. The processor 601 is configured to execute a program of the control method stored in the memory, to implement operations of the control method provided in the above embodiments.

[0191] An embodiment of the application further provides a computer-readable storage medium. In the embodiment of the application, when the above control method is implemented in form of a software function module and sold or used as an independent product, the above control method may be stored in a computer-readable storage medium. Based on such understanding, the technical solutions of the embodiments of the application substantially or parts making contributions to the related art may be embodied in form of a software product, and the computer software product is stored in a storage medium, includes several instructions to enable a computer device (which may be a personal computer, a server, or a network device, etc.) to execute the whole or part of the method described in each embodiment of the application. The foregoing storage medium includes various media capable of storing program codes, such as a U disk, a mobile hard disk, a Read Only Memory (ROM), a magnetic disk or an optical disk, etc. As such, the embodiments of the application are not limited to any specific combination of hardware and software.

[0192] Correspondingly, an embodiment of the application provides a computer-readable storage medium, having stored thereon a computer program. Operations of the control method provided in the above embodiments are implemented when the computer program is executed by a processor.

[0193] The above descriptions of the embodiments of the clothes treatment device and the storage medium are similar to the above descriptions of the method embodiments, and have advantageous effects similar to the method embodiments. Technical details which are not disclosed in the embodiments of the clothes treatment device and the storage medium of the application, may be understood with reference to the descriptions of the method embodiments of the application.

[0194] It should be understood that reference is made to "one embodiment" or "an embodiment" throughout the description, which means that specific features, structures or characteristics associated with the embodiment are included in at least one embodiment of the application. Therefore, appearances of "in one embodiment" or "in an embodiment" in various places throughout the description do not necessarily refer to the same embodiment. Furthermore, these specific features, structures or characteristics may be combined in one or more embodiments in any suitable manner. It should be understood that in various embodiments of the application, sizes of serial numbers of the above processes does not mean execution sequences thereof, and the execution sequence of each process should be determined by its functions and internal logics, and should not constitute any limitation to implementations of the embodiments of the application. Serial numbers of the above embodiments of the application are only intended for descriptions, and do not represent advantages or disadvantages of the embodiments.

[0195] It should be noted that terms "include", "including" or any other variants thereof here are intended to encompass non-exclusive inclusion, so that a process, method, article or apparatus including a series of elements not only includes those elements, but also includes other elements which are not explicitly listed, or includes elements inherent to such process, method, article or apparatus. Without any further limitation, an element defined by a phrase "including a..." does not preclude presence of additional identical elements in a process, method, article or apparatus including the element.

[0196] In several embodiments provided in the application, it should be understood that the disclosed devices and methods may be implemented in other ways. For example, the above device embodiments are only illustrative. For example, division of the units is only a logical function division. In an actual implementation, there may be other division manners. For example, multiple units or components may be combined or may be integrated into another system, or some features may be ignored or may not be performed. Furthermore, mutual coupling or direct coupling or communication connection among components as shown or discussed may be indirect coupling or communication connection through some interfaces, devices or units, and may be in electrical, mechanical or other forms.

[0197] The units described as separate components may be or may not be physically separated, and the components displayed as units may be or may not be physical units, that is, they may be located in one place, or may be distributed on multiple network units. Part or all of the units may be selected according to actual requirements, to achieve the purpose of the solutions of the embodiments.

[0198] Furthermore, each function unit in each embodiment of the application may be integrated into one processing unit, or each unit may be separately used as a unit respectively, or two or more units may be integrated into one unit. The above integrated unit may be implemented in form of hardware or in form of hardware plus software function units.

[0199] It may be understood by those of ordinary skill in the art that all or part of operations implementing the above method embodiments may be completed by hardware related to program instructions, the foregoing program may be stored in a computer-readable storage me-

dium, and when the program is executed, operations including the above method embodiments are executed; and the foregoing storage medium includes various media capable of storing program codes, such as a mobile storage device, a ROM, a magnetic disk or an optical disk, etc.

[0200] Or, when the above integrated unit of the application is implemented in form of a software function module and sold or used as an independent product, the above integrated unit may be stored in a computer-readable storage medium. Based on such understanding, the technical solutions of the embodiments of the application substantially or parts making contributions to the related art may be embodied in form of a software product, and the computer software product is stored in a storage medium, includes several instructions to enable a product to execute the whole or part of the method described in each embodiment of the application. The foregoing storage medium includes various media capable of storing program codes, such as a a mobile storage device, a ROM, a magnetic disk or an optical disk, etc.

[0201] The above descriptions are only implementations of the application, however, the scope of protection of the application is not limited thereto. Any variation or replacement easily conceived by those skilled in the art within the technical scope disclosed by the application should be included in the scope of protection of the application. Therefore, the scope of protection of the application should be subjected to the scope of protection of claims.

INDUSTRIAL APPLICABILITY

[0202] The embodiments of the application provide a control method, a control apparatus, a control device, and a computer-readable storage medium, which are applied to a clothes treatment device. The method includes the following operations. It is determined that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and a steam generation apparatus of the clothes treatment device is controlled to stop generating steam. The first rotational speed is equal to or greater than a critical rotational speed. In this way, after the rotational speed of the tub body reaches the critical rotational speed, the clothes in the tub body are affixed to a tub wall and are not present at the center of the tub body. At this time, the steam generation apparatus is turned off to stop generating steam, which reduces energy consumption of the clothes treatment device and prevents the steam from passing through the center of the tub body without clothes, thus resulting in waste; furthermore, after generation of the steam is stopped, the steam introduced into the tub body is reduced, which may reduce humidity of the clothes in the tub body and improve clothes treatment efficiency.

Claims

1. A control method, applied to a clothes treatment device, comprising:
determining that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and controlling a steam generation apparatus of the clothes treatment device to stop generating steam, wherein the first rotational speed is equal to or greater than a critical rotational speed.

2. The method of claim 1, comprising:

controlling the clothes treatment device to operate in a first operation mode,
wherein the first operation mode comprises: turning off the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

3. The method of claim 1, comprising:

controlling the clothes treatment device to operate in a second operation mode,
wherein the second operation mode comprises: turning on the steam generation apparatus, turning on a drying fan of the clothes treatment device, and turning on a drying heater of the clothes treatment device.

4. The method of claim 2 or 3, comprising:

controlling the tub body to operate at a second rotational speed and then operate at a third rotational speed,
wherein the third rotational speed is equal to or greater than the second rotational speed, and both the second rotational speed and the third rotational speed are less than the critical rotational speed.

5. The method of claim 4, further comprising:
determining that a duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration, and controlling the tub body to operate at the first rotational speed.

6. The method of any one of claims 1 to 5, further comprising:

controlling the tub body to operate at a first beat, wherein the first beat comprises a first rotation duration and a first stop duration, the first rotation duration is equal to or greater than a rotation duration threshold, and the first stop duration is less than or equal to a stop duration threshold.

7. The method of claim 6, further comprising:

controlling the clothes treatment device to operate in a third operation mode,
wherein the third operation mode comprises: turning on the steam generation apparatus, turning off a drying fan of the clothes treatment device, and turning off a drying heater of the clothes treatment device.

8. The method of claim 7, further comprising:

controlling the tub body to operate at a second beat,
wherein the second beat comprises a second rotation duration and a second stop duration, the second rotation duration is less than the rotation duration threshold, the second stop duration is less than or equal to the stop duration threshold, and the second beat is weaker than the first beat.

9. A control apparatus, applied to a clothes treatment device, comprising:
a first control module, configured to determine that a rotational speed of a tub body of the clothes treatment device reaches a first rotational speed, and control a steam generation apparatus of the clothes treatment device to stop generating steam, wherein the first rotational speed is equal to or greater than a critical rotational speed.

10. A control device, comprising:

a memory, configured to store executable instructions; and
a processor, configured to implement the method of any one of claims 1 to 8 when the processor executes the executable instructions stored in the memory.

11. A computer-readable storage medium, having stored thereon computer-executable instructions, the computer-executable instructions configured to implement the method of any one of claims 1 to 8 when the computer-executable instructions are executed by a processor.

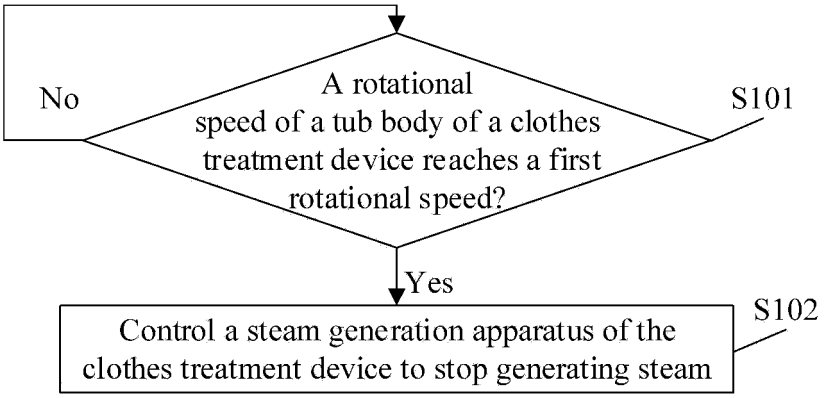
No
A rotational speed of a tub body of a clothes treatment device reaches a first rotational speed?
S101
Yes
Control a steam generation apparatus of the clothes treatment device to stop generating steam
S102

FIG. 1

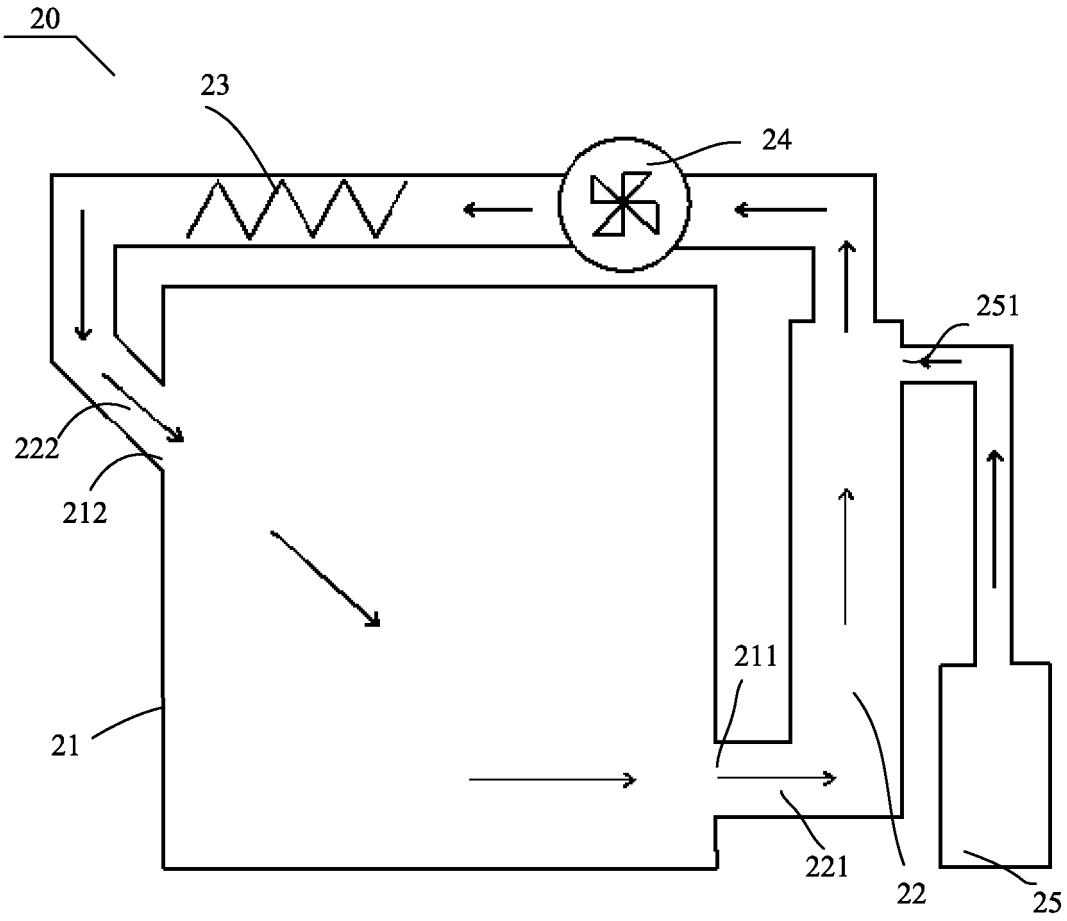
20
23
24
251
222
212
211
21
221
22
25

FIG. 2

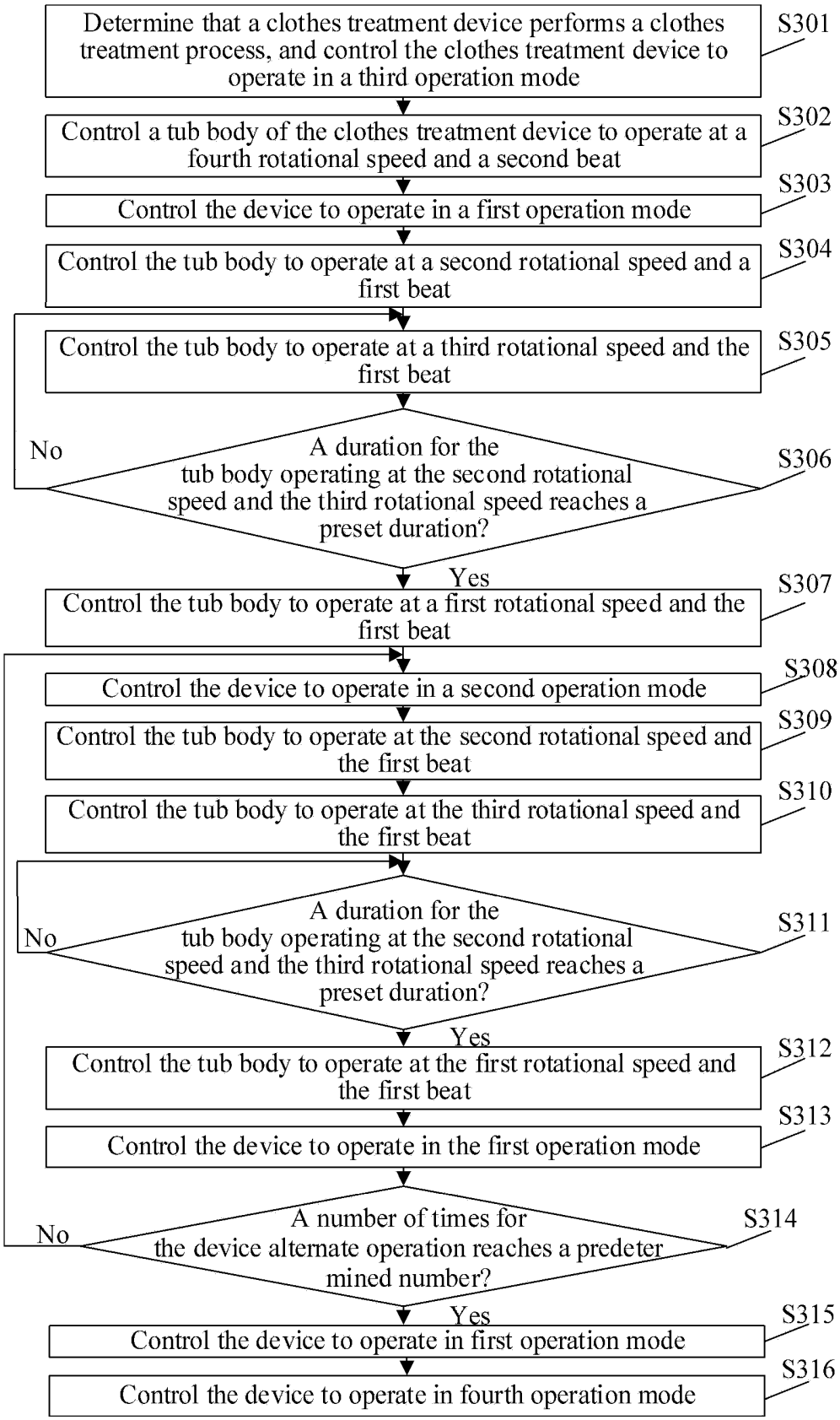
Determine that a clothes treatment device performs a clothes treatment process, and control the clothes treatment device to operate in a third operation mode
S301
Control a tub body of the clothes treatment device to operate at a fourth rotational speed and a second beat
S302
Control the device to operate in a first operation mode
S303
Control the tub body to operate at a second rotational speed and a first beat
S304
Control the tub body to operate at a third rotational speed and the first beat
S305
A duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration?
S306
No
Yes
Control the tub body to operate at a first rotational speed and the first beat
S307
Control the device to operate in a second operation mode
S308
Control the tub body to operate at the second rotational speed and the first beat
S309
Control the tub body to operate at the third rotational speed and the first beat
S310
A duration for the tub body operating at the second rotational speed and the third rotational speed reaches a preset duration?
S311
No
Yes
Control the tub body to operate at the first rotational speed and the first beat
S312
Control the device to operate in the first operation mode
S313
A number of times for the device alternate operation reaches a predetermined number?
S314
No
Yes
Control the device to operate in first operation mode
S315
Control the device to operate in fourth operation mode
S316

FIG. 3

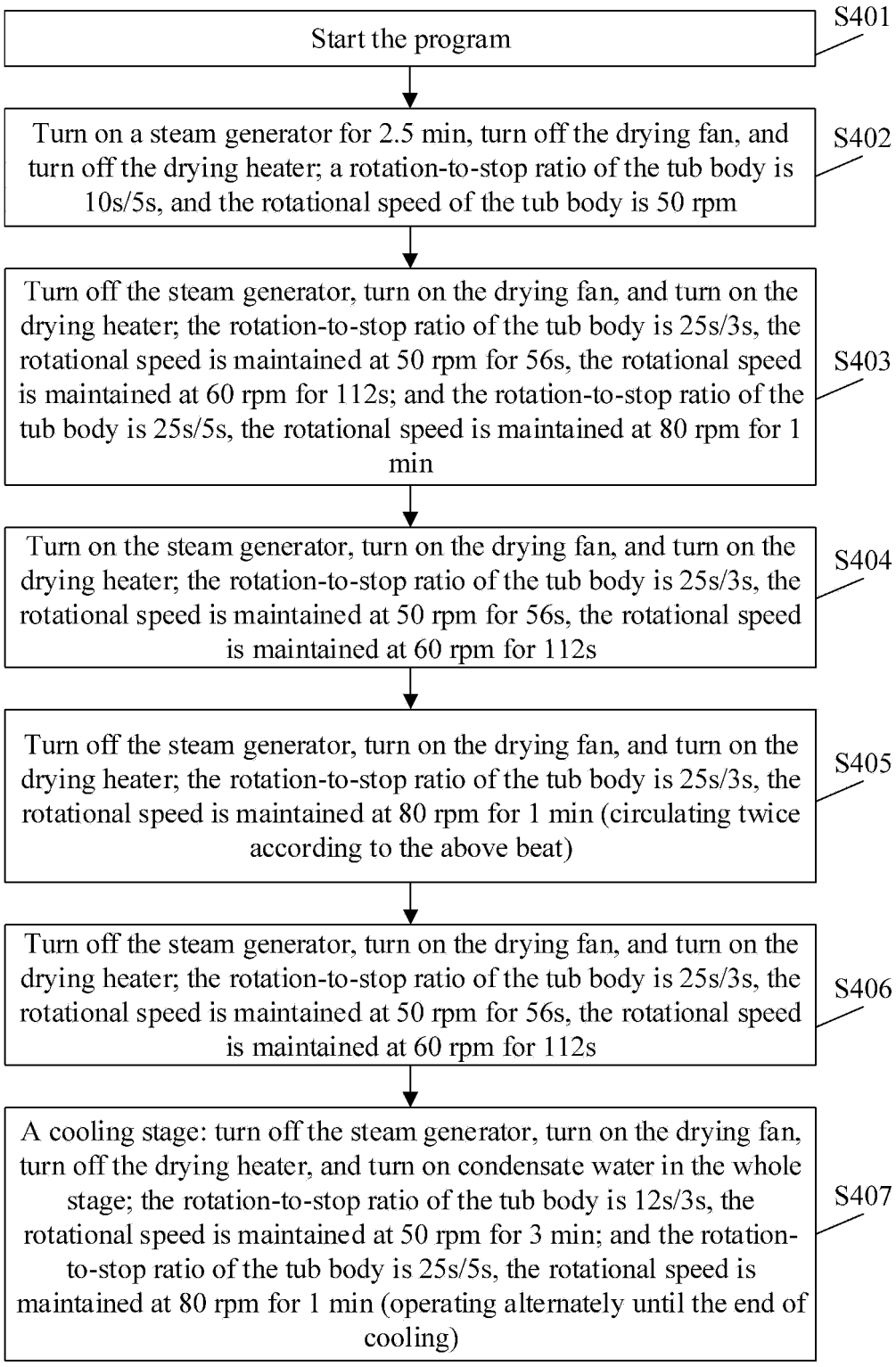
Start the program
S401
Turn on a steam generator for 2.5 min, turn off the drying fan, and turn off the drying heater; a rotation-to-stop ratio of the tub body is 10s/5s, and the rotational speed of the tub body is 50 rpm
S402
Turn off the steam generator, turn on the drying fan, and turn on the drying heater; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s; and the rotation-to-stop ratio of the tub body is 25s/5s, the rotational speed is maintained at 80 rpm for 1 min
S403
Turn on the steam generator, turn on the drying fan, and turn on the drying heater; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s
S404
Turn off the steam generator, turn on the drying fan, and turn on the drying heater; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 80 rpm for 1 min (circulating twice according to the above beat)
S405
Turn off the steam generator, turn on the drying fan, and turn on the drying heater; the rotation-to-stop ratio of the tub body is 25s/3s, the rotational speed is maintained at 50 rpm for 56s, the rotational speed is maintained at 60 rpm for 112s
S406
A cooling stage: turn off the steam generator, turn on the drying fan, turn off the drying heater, and turn on condensate water in the whole stage; the rotation-to-stop ratio of the tub body is 12s/3s, the rotational speed is maintained at 50 rpm for 3 min; and the rotation-to-stop ratio of the tub body is 25s/5s, the rotational speed is maintained at 80 rpm for 1 min (operating alternately until the end of cooling)
S407

FIG. 4

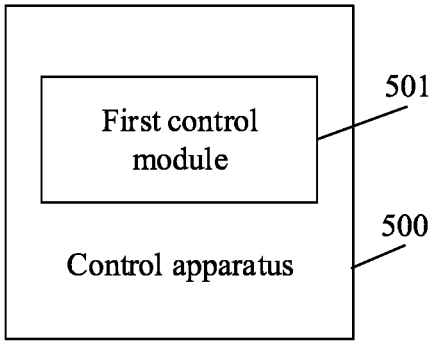
First control module
501
500
Control apparatus

FIG. 5

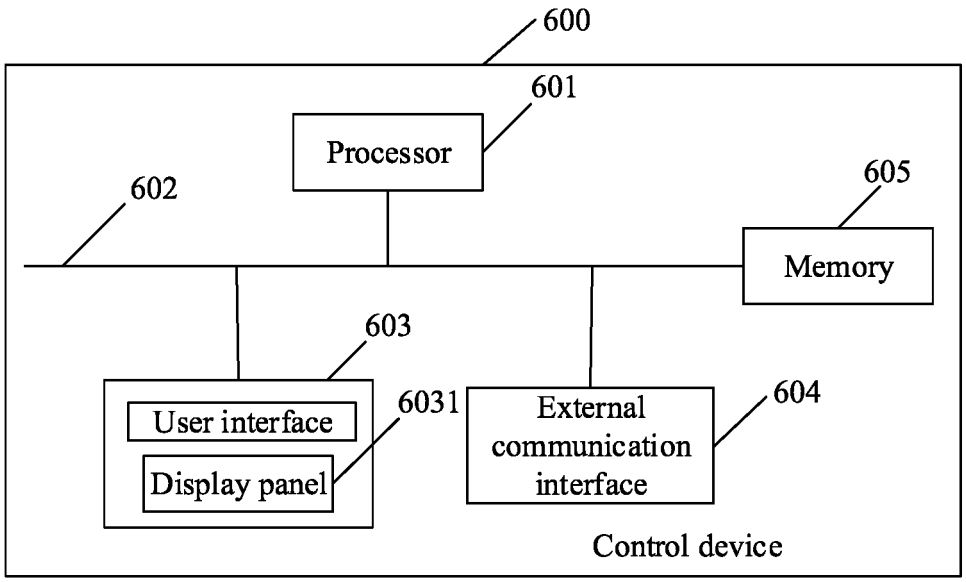
600
601
Processor
602
605
Memory
603
User interface
6031
Display panel
External communication interface
604
Control device

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/129375

A. CLASSIFICATION OF SUBJECT MATTER

D06F 58/36(2020.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI; SIPOABS; CNKI; CNABS; CNTXT: 蒸汽, 蒸气, 烘干, 干燥, 干衣, 烘衣, 断开, 关闭, 关掉, 未开启, 不开启, 不启动, 未启动, 不开, 不启动, 加热, 发热, 风机, 风扇, 送风, 吹风, 水汽, 筒, 桶, 槽, 速度, 转数, 转速, 临界, 紧贴, 贴附, 附着, 贴壁, 粘附, critical, threshold, speed, revolution, drum, tub, basket, cylinder, buffer, tumble, roller, fan, blower, steam, vapour, clos+, open+, start+, shut+, stop+, dry+, drier

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 111041765 A (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 21 April 2020 (2020-04-21) description, paragraphs [0032]-[0045], and figures 1-2	1, 9-11
Y	CN 111041765 A (ZHUHAI GREE ELECTRIC APPLIANCES INC.) 21 April 2020 (2020-04-21) description, paragraphs [0032]-[0045], and figures 1-2	2-8
Y	CN 108004738 A (WUXI FEILING ELECTRONIC CO., LTD.) 08 May 2018 (2018-05-08) description, paragraphs [0036]-[0103], and figures 1-6	2-8
PX	CN 113235280 A (WUXI LITTLE SWAN ELECTRIC CO., LTD.) 10 August 2021 (2021-08-10) description, paragraphs [0044]-[0201], and figures 1-6	1-11
A	CN 1888189 A (LG ELECTRONICS (TIANJIN) ELECTRICAL APPLIANCES CO., LTD.) 03 January 2007 (2007-01-03) entire document	1-11

☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
12 January 2022	**27 January 2022**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088, China** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/129375

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009273686 A (TOSHIBA CORP. et al.) 26 November 2009 (2009-11-26) entire document	1-11
A	CN 104846608 A (WUXI LITTLE SWAN CO., LTD.) 19 August 2015 (2015-08-19) entire document	1-11
A	EP 2426245 A1 (MIELE & CIE. KG) 07 March 2012 (2012-03-07) entire document	1-11

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2021/129375

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	111041765	A	21 April 2020	CN	211596100	U	29 September 2020
CN	108004738	A	08 May 2018	CN	108004738	B	12 January 2021
CN	113235280	A	10 August 2021		None		
CN	1888189	A	03 January 2007		None		
JP	2009273686	A	26 November 2009		None		
CN	104846608	A	19 August 2015		None		
EP	2426245	A1	07 March 2012	EP	2426245	B1	24 December 2014
				EP	2426245	B9	15 April 2015
				ES	2528728	T3	12 February 2015
				PL	2426245	T3	30 April 2015

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- CN 202110378907 **[0001]**