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(54) **CONTROL METHOD AND APPARATUS FOR CLOTHES DRYING DEVICE, CLOTHES DRYING DEVICE AND STORAGE MEDIUM**

(57) Provided are a method and apparatus for controlling a clothes dryer, a clothes dryer, and a storage medium. The method includes controlling the drum motor to rotate according to a preset rotation speed value to drive the drum; acquiring the weight value of clothes in the drum; determining the target rotation speed value of the fan motor based on the weight value; and controlling the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes. The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

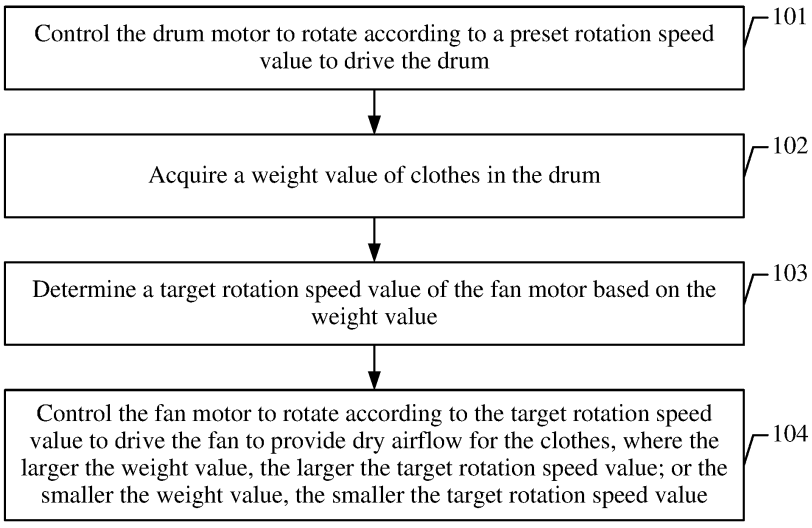

FIG. 1

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Description

[0001] This application claims priority to Chinese Patent Application No. 202111503663.1 filed with the China National Intellectual Property Administration (CNIPA) on Dec. 10, 2021, the disclosure of which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] Embodiments of the present application relate to a home appliance control technology, for example, a method and apparatus for controlling a clothes dryer, a clothes dryer, and a storage medium.

BACKGROUND

[0003] Currently, a drum clothes dryer is usually driven by one motor, that is, the motor is used to drive the fan and the drum simultaneously. The rotation speed of the drum is tightly bound to the speed of the wind. The higher the rotation speed of the drum, the higher the speed of the wind. The lower the rotation speed of the drum, the lower the speed of the wind. This control method lacks flexibility and has limited application scenarios, unable to satisfy the diverse control requirements in various scenarios. Moreover, there is room for improvement in the drying effectiveness of this method. For example, in certain application scenarios, it is needed to control the fan to rotate and the drum not to rotate or control the fan to rotate fast and the drum to rotate slowly. This is impossible when only one motor is used to drive the fan and the drum simultaneously.

SUMMARY

[0004] Embodiments of the present application provide a method and apparatus for controlling a clothes dryer, a clothes dryer, and a storage medium.

[0005] In a first aspect, embodiments of the present application provide a method for controlling a clothes dryer. The clothes dryer includes a drum driven by a drum motor and a fan driven by a fan motor. The method includes controlling the drum motor to rotate according to a preset rotation speed value to drive the drum; acquiring a weight value of clothes in the drum; determining a target rotation speed value of the fan motor based on the weight value; and controlling the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes.

[0006] The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0007] In a second aspect, embodiments of the present application provide an apparatus for controlling a clothes dryer. The clothes dryer includes a drum driven by a drum motor and a fan driven by a fan motor. The apparatus includes a drum control module, an acquisition module, a determination module, and a fan control module.

[0008] The drum control module is configured to control the drum motor to rotate according to a preset rotation speed value to drive the drum.

[0009] The acquisition module is configured to acquire the weight value of clothes in the drum.

[0010] The determination module is configured to determine the target rotation speed value of the fan motor based on the weight value.

[0011] The fan control module is configured to control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes.

[0012] The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0013] In a third aspect, embodiments of the present application also provide a clothes dryer. The clothes dryer includes a memory, a processor, and a computer program stored in the memory and executable on the processor. The processor is configured to, when executing the computer program, perform the method for controlling a clothes dryer according to any embodiment of the present application.

[0014] In a fourth aspect, embodiments of the present application also provide a computer-readable storage medium storing a computer program which, when executed by a processor, causes the processor to perform the method for controlling a clothes dryer according to any embodiment of the present application.

BRIEF DESCRIPTION OF DRAWINGS

[0015]

FIG. 1 is a flowchart of a method for controlling a clothes dryer according to embodiments of the present application.

FIG. 2 is a graph of a preset function according to embodiments of the present application.

FIG. 3 is another flowchart of the method for controlling a clothes dryer according to embodiments of the present application.

FIG. 4 is a diagram illustrating the structure of an apparatus for controlling a clothes dryer according to embodiments of the present application.

FIG. 5 is a diagram illustrating the structure of a clothes dryer according to embodiments of the present application.

DETAILED DESCRIPTION

[0016] Embodiments of the present application provide a method and apparatus for controlling a clothes dryer, a clothes dryer, and a storage medium to satisfy the control requirements in various application scenarios and improve the clothes drying effect.

[0017] The present application is described hereinafter in conjunction with drawings and embodiments.

[0018] FIG. 1 is a flowchart of a method for controlling a clothes dryer according to embodiments of the present application. This method can be executed by an apparatus for controlling a clothes dryer according to embodiments of the present application. The apparatus may be implemented by software and/or hardware. In an embodiment, the apparatus may be integrated in a clothes dryer. The clothes dryer may be, for example, a clothes drying machine. The following describes an example in which the apparatus is integrated in the clothes dryer. Referring to FIG. 1, the method includes the following steps:

[0019] In step 101, the drum motor is controlled to rotate according to a preset rotation speed value to drive the drum.

[0020] For example, the clothes dryer may include a drum driven by a drum motor and a fan driven by a fan motor. The drum motor and the fan motor are independent of each other. The drum motor and the fan motor may have the same or different performance parameters. The drum motor may be either a fixed-frequency motor or a variable-frequency motor while the fan motor may be a variable-frequency motor. The preset rotation speed value may be preset according to theoretical data or experimental data. This value affects the rotation speed of the drum. Typically, when the drum rotates at around 50 revolutions per minute (RPM), the clothes can be well rotated and scattered, facilitating drying. Therefore, the preset rotation speed value may be set based on this rotation speed. One or more preset rotation speed values may be provided so that the drum can be controlled to rotate at a fixed speed or at a variable speed.

[0021] For example, to improve the clothes drying effect and shorten the clothes drying duration, it is feasible to remove water from the clothes, put the water-removed clothes into the drum of the clothes dryer, and then use the drum motor to drive the drum to rotate according to the preset rotation speed value after the clothes dryer is started. For example, to prevent the clothes from tangling and clumping together inside the drum, it is feasible to drive the drum to rotate forwards and backwards for the same duration, for example, rotate forwards for one minute, then backwards for one minute, then forwards for one minute, and so on.

[0022] In step 102, a weight value of clothes in the drum is acquired.

[0023] For example, the weight value may be the initial weight value of the clothes placed in the drum, that is, the weight value of the clothes not dried. Alternatively, the weight value may be the real-time weight value of the clothes, that is, the weight value acquired in real time in the process of drying the clothes. For example, the weight value of the clothes may be acquired in the following manner:

[0024] Manner one: At least one of the load power or the load current of the drum motor is acquired; and the weight value of the clothes is determined based on the at least one of the load power or the load current. That is, the load power of the drum motor and the load current of the drum motor are increased after the clothes are put into the drum; and it is feasible to detect the at least one of the load power or the load current of the drum motor before the clothes are put into the drum and the at least one of the load power or the load current of the drum motor after the clothes are put into the drum and calculate the weight value of the clothes based on the difference between the at least one of the load power or the load current of the drum motor before the clothes are put into the drum and the at least one of the load power or the load current of the drum motor after the clothes are put into the drum.

[0025] Manner two: A clothes collision frequency and a clothes collision amplitude that are detected by a clothes sensor in the drum are acquired; and the weight value of the clothes is determined based on the clothes collision frequency and the clothes collision amplitude. That is, a clothes sensor may be disposed on the front support of the drum, the clothes sensor may be a bimetallic sensor, the clothes tumbling in the drum may touch the clothes sensor, the clothes sensor may be connected to an oscillating circuit, the oscillating circuit may detect the resistance value of the clothes, the clothes collision frequency and the clothes collision amplitude may be calculated according to the resistance value of the clothes, and the weight value of the clothes may be calculated according to the clothes collision frequency and the clothes collision amplitude.

[0026] The preceding two manners of measuring the weight of the clothes are examples not intended to limit the embodiments. In practical use, the weight of the clothes may be measured in other manners according to the requirements.

[0027] In step 103, a target rotation speed value of the fan motor is determined based on the weight value.

[0028] For example, the target rotation speed value may be determined according to preset weight-rotation speed relationship information, the weight-rotation speed relationship information may include a rotation speed value corresponding to each weight value, the target rotation speed value may be obtained by querying the weight-rotation speed relationship information based on the current weight value of the clothes, and the weight-rotation speed relationship information may be set according to experiments or experience. In an embodiment, the weight-rotation speed relationship information may be stored in the clothes dryer in the form of a table, for example, Table 1.

Table 1

Weight Value of the Clothes	Rotation Speed Value of the Fan Motor
A1	B1
A2	B2
A3	B3
A4	B4

[0029] In the weight-rotation speed relationship information listed in Table 1, the larger the weight value, the larger the rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0030] For example, it is feasible to determine the target rotation speed value of the fan motor based on the weight value by using a preset function. The preset function includes a linear function or a quadratic function. The independent variable of the preset function is the weight. The dependent variable of the preset function is the rotation speed.

[0031] For example, as shown in FIG. 2, the preset function is a quadratic function in the following form:

$$y = ax^2 + bx + c$$

[0032] y indicates the rotation speed. x indicates the weight. a, b, and c are all parameters. The value of a, the value of b, and the value of c are all greater than 0. For example, c > 1000.

[0033] Illustratively, as shown in FIG. 2, the preset function may also be a primary function in the following manner:

$$y = bx + c$$

[0034] It can be learned from the graph of the primary function and the quadratic function shown in FIG. 2 that the larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0035] For example, the value range of the rotation speed of the fan motor may be [2000 RPM, 3000 RPM], and the value range of the weight may be [0, 10 kg], that is, 0 kg corresponds to 2000 RPM, and 10 kg corresponds to 3000 RPM, thus ensuring the drying speed of the clothes.

[0036] In step 104, the fan motor is controlled to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes. The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0037] In an example, the fan motor may be controlled to rotate at a fixed speed according to the target rotation speed value to drive the fan or may be controlled to rotate at a variable speed according to the target rotation speed value to drive the fan. For example, when the weight value is the initial weight value of the clothes, it is feasible to determine the fixed target rotation speed value of the fan motor based on the initial weight value and control the fan motor to rotate at a fixed speed according to the fixed target rotation speed value to drive the fan to rotate, that is, rotate at a constant speed in the process of drying the clothes. Alternatively, when the weight value is the real-time weight value of the clothes, it is feasible to determine the real-time target rotation speed value of the fan motor based on the real-time weight value and control the fan motor to rotate at a variable speed according to the real-time target rotation speed value, that is, rotate at a speed that varies with the weight of the clothes in the process of drying the clothes. The variable speed varies as follows: The lighter the clothes (the smaller the weight value), the lower the rotation speed (the smaller the rotation speed); and the heavier the clothes, the higher the rotation speed.

[0038] The clothes dryer of embodiments of the present application uses double drives. The drum and the fan of the

clothes dryer are driven independently of each other. The drum can be driven by the drum motor while the fan can be driven by the fan motor. The rotation speed of the drum is independent of the rotation speed of the fan, offering flexibility in control and catering to a wider range of control requirements in various application scenarios. Moreover, the driving speed of the fan motor can be determined on site based on the weight of the clothes, ensuring that the rotation speed of the fan is better matched to the actual application scenario and thus enhancing the clothes drying effectiveness.

[0039] In an embodiment, the clothes dryer may include multiple fans driven by a fan motor, and the airflow direction of each fan is adjustable. These fans may be driven by a single fan motor or by different fan motors. When drying clothes, all of the multiple fans or part of the multiple fans may be driven simultaneously. The number of driven fans may be determined according to the actual requirements.

[0040] That is, the step of controlling the fan motor to rotate according to the target rotation speed value to drive the fan may include the following:

(1) The target fan is selected from the multiple fans.

[0041] For example, the target fan may be selected from the multiple fans according to the weight value of the clothes and/or a preset clothes drying duration.

(2) The fan motor is controlled to rotate according to the target rotation speed value to drive the target fan.

[0042] For example, in practical use, the number of fans to be driven may be determined based on the weight value of the clothes. The larger the weight of the clothes, the more the fans to be driven. For example, when there are a total of two fans, it is feasible to drive one fan when there are fewer clothes and drive two fans simultaneously when there are more clothes. Alternatively, the number of fans to be driven may also be determined based on the drying duration set by the user. The shorter the drying duration, the more the fans to be driven. For example, there are a total of four fans, the four fans may be driven when the preset clothes drying duration is 1.5 hours, and two of the four fans may be driven when the preset duration is three hours. Alternatively, the number of fans to be driven may also be determined based on both the weight value of the clothes and the preset clothes drying duration.

[0043] It is feasible to adjust the airflow directions of the fans in the following manner: The humidity of the clothes in the drum is detected so that a humidity distribution map is obtained. For the area having a higher humidity on the distribution map, it is feasible to adjust the airflow directions of the fans such that the fans focally blow air to the area having a higher humidity to increase the clothes drying speed or it is feasible to adjust the airflow directions of the fans such that the fans can evenly blow air to the drum.

[0044] In an embodiment, it is feasible to use natural wind to dry the clothes, that is, control the fan motor to drive the fan to bring natural wind into the drum to make moisture in the clothes in the drum evaporate so that the clothes are dried. The temperature of natural wind is affected by the ambient temperature. The higher the ambient temperature, the higher the temperature of natural wind, and the faster the clothes are dried. In practical use, it is feasible to determine the target rotation speed value of the fan motor based on a combination of the ambient temperature and the weight of the clothes.

[0045] For example, it is feasible to determine the current ambient temperature first, determine the target rotation speed range based on the current ambient temperature, and then determine the target rotation speed value from the target rotation speed range based on the weight value of the clothes. In practical use, different ambient temperatures may correspond to different rotation speed ranges. The relationship between the ambient temperatures and the rotation speed ranges may be preset according to actual requirements. For example, if the drying speed is the primary factor taken into consideration, the faster the drying speed, the better, and it is feasible to configure that the lower the ambient temperature, the higher the rotation speed in the rotation speed range and it is feasible to improve the rotation speed to alleviate the slow drying speed caused by a low ambient temperature (low temperature of dry airflow). For another example, if energy saving is the primary factor taken into consideration, the smaller the energy consumption, the better, it is feasible to configure that the higher the ambient temperature, the lower the rotation speed in the rotation speed range and it is feasible to use high-temperature natural wind (high-temperature dry airflow) to alleviate the slow drying speed caused by a low rotation speed. In practical use, it is also feasible to set the relationship between the ambient temperatures and the rotation speed ranges based on other factors taken into consideration. This is not limited here.

[0046] In an embodiment, it is also feasible to use warm air to dry the clothes, that is, it is feasible to add a heater to the air outlet of the fan, use the heater to heat the natural wind from the fan and bring the heated natural wind to the drum, and use the warm air to make evaporated moisture in the clothes in the drum to dry the clothes. The heater may be, for example, an electric heating wire or a semiconductor heater. When using warm air to dry the clothes, the temperature of the warm air may be set according to the material of the clothes. Generally, the temperature of the warm air should not exceed 60°, optimally 55°. If the temperature is too high, the clothes may be damaged; and if the temperature is too low, the drying speed is slow.

[0047] FIG. 3 shows a method for controlling a clothes dryer that uses warm air to dry clothes. As shown in FIG.3, the method may include the following steps:

[0048] In step 301, the drum motor is controlled to rotate according to a preset rotation speed value to drive the drum to rotate forwards and backwards for the same duration.

[0049] The preset rotation speed value may include one or more rotation speed values. That is, the drum motor may rotate at a fixed speed or may rotate at a variable speed. The drum motor is configured to drive the drum to rotate forwards and backwards for the same duration, preventing the clothes from tangling and clumping together inside the drum and increasing the clothes drying speed.

[0050] In step 302, a weight value of the clothes in the drum is acquired.

[0051] For example, the weight value of the clothes may be determined based on the load power and/or the load current of the drum motor or may be determined based on the clothes collision frequency and the clothes collision amplitude that are detected by the clothes sensor in the drum. The determined weight value of the clothes may be the initial weight value of the clothes or the real-time weight value of the clothes.

[0052] In step 303, a target rotation speed value of the fan motor is determined based on the weight value.

[0053] The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value. In embodiments of the present application, the rotation speed value of the fan motor may not be affected by the rotation speed value of the drum motor. The fan motor and the drum motor may have the same or different rotation speed values according to the actual requirements.

[0054] In step 304, the heater is started, and the fan motor is controlled to rotate according to the target rotation speed value to drive the fan to rotate forwards to provide dry airflow for the clothes.

[0055] After the heater is started, the heater heats the sucked natural wind to obtain hot wind, and the fan motor drives the fan to rotate to bring the hot wind into the drum, making moisture in the clothes in the drum evaporate.

[0056] In step 305, it is determined whether a clothes cooling condition is satisfied; if the clothes cooling condition is satisfied, step 306 is performed; and if the clothes cooling condition is not satisfied, step 304 is performed.

[0057] Cooling means the heating stops, that is, the heater stops heating, but the fan motor continues working, and low-temperature natural wind enters the drum to cool the clothes to prevent the clothes from wrinkling. The clothes cooling condition may be, for example, a time condition, a clothes dryness degree condition, or a temperature condition. For example, it is feasible to determine whether the execution duration of the clothes drying program reaches a specified duration and determine that the cooling condition is satisfied when the execution duration of the clothes drying program reaches the specified duration; or it is feasible to determine whether the dryness degree of the clothes reaches a specified dryness degree and determine that the cooling condition is satisfied when the dryness degree of the clothes reaches the specified dryness degree; or it is feasible to determine whether the temperature in the drum reaches a specified temperature and determine that the cooling condition is satisfied when the temperature in the drum reaches the specified temperature.

[0058] For example, the total running duration of the clothes drying program is 2 hours. This duration is divided into two phases. The first phase is the drying phase: the first 1.5 hours. The second phase is the cooling phase: the last 0.5 hours. When it is detected that the clothes drying program runs to 1.5 hours, it is determined that the clothes cooling condition is reached.

[0059] For example, it is feasible to detect the dryness degree of the clothes in the drum. It is feasible to detect the dryness degree of the clothes according to variation of the weight of the clothes. For example, when the amount of variation of the weight of the clothes is less than a fixed value (for example, 0.1 kg) within a specified duration (for example, 5 minutes), it may be determined that the dryness degree of the clothes reaches the specified dryness degree. It is also feasible to determine the dryness degree of the clothes by detecting humidity of air released from the drum. For example, when the detected humidity of the air released from the drum is continuously less than a specified humidity value (for example, 10%) within a specified duration (for example, 3 minutes), it may be determined that the dryness degree of the clothes reaches the specified dryness degree. Once the clothes reach the specified dryness degree, it is determined that the clothes cooling condition is satisfied.

[0060] For example, it is feasible to detect the temperature in the drum. When the temperature in the drum is higher than a specified temperature (for example, 65 degrees), it is determined that the clothes cooling condition is satisfied. The heater may be aged or faulty, causing an excessively high heating temperature that is higher than the rated heating temperature set by the user. To avoid damage to the clothes due to the high temperature, a cooling program may be started when the temperature in the drum is detected to be higher than the specified temperature.

[0061] In step 306, the heater is turned off, and the fan motor is controlled to rotate according to a specified rotation speed value to drive the fan to rotate forwards to provide cooling airflow for the clothes.

[0062] The specified rotation speed value may be set to a fixed value according to the actual requirements.

[0063] The clothes dryer of embodiments of the present application uses double drives. The drum and the fan of the clothes dryer are driven independently of each other. The drum may be driven by the drum motor while the fan may be driven by the fan motor. The rotation speed of the drum is independent of the rotation speed of the fan, offering flexibility in control and catering to a wider range of control requirements in various application scenarios. Moreover, the driving speed of the fan motor can be determined on site based on the weight of the clothes, ensuring that the rotation speed

of the fan is better matched to the actual application scenario and thus enhancing the clothes drying effectiveness.

[0064] FIG. 4 is a diagram illustrating the structure of an apparatus for controlling a clothes dryer according to embodiments of the present application. The apparatus includes a drum driven by a drum motor and a fan driven by a fan motor. The apparatus is applicable to the method for controlling the clothes dryer according to any embodiment of the present application. As shown in FIG. 4, the apparatus includes a drum control module 401, an acquisition module 402, a determination module 403, and a fan control module 404.

[0065] The drum control module 401 is configured to control the drum motor to rotate according to a preset rotation speed value to drive the drum.

[0066] The acquisition module 402 is configured to acquire a weight value of clothes in the drum.

[0067] The determination module 403 is configured to determine a target rotation speed value of the fan motor based on the weight value.

[0068] The fan control module 404 is configured to control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes.

[0069] The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0070] In an embodiment, the weight value of the clothes includes an initial weight value of the clothes.

[0071] The determination module 403 is configured to determine a fixed target rotation speed value of the fan motor based on the initial weight value.

[0072] The fan control module 404 is configured to control the fan motor to rotate at a fixed speed according to the fixed target rotation speed value to drive the fan.

[0073] In an embodiment, the weight value of the clothes includes a real-time weight value of the clothes.

[0074] The determination module 403 is configured to determine a real-time target rotation speed value of the fan motor based on the real-time weight value.

[0075] The fan control module 404 is configured to control the fan motor to rotate at a variable speed according to the real-time target rotation speed value to drive the fan.

[0076] In an embodiment, the drum control module 401 is configured to control the drum motor to rotate according to the preset rotation speed value to drive the drum to rotate forwards and backwards.

[0077] In an embodiment, the drum control module 401 is configured to control the drum motor to rotate according to the preset rotation speed value to drive the drum to rotate forwards and backwards for the same duration.

[0078] In an embodiment, the determination module 403 is configured to determine the target rotation speed value of the fan motor based on the weight value by using a preset function. The preset function includes a linear function or a quadratic function. The independent variable of the preset function is the weight. The dependent variable of the preset function is the rotation speed.

[0079] In an embodiment, the acquisition module 402 is configured to acquire at least one of load power or load current of the drum motor and determine the weight value of the clothes based on the at least one of the load power or the load current.

[0080] In an embodiment, the acquisition module 402 is configured to acquire a clothes collision frequency and a clothes collision amplitude that are detected by a clothes sensor in the drum; and determine the weight value of the clothes based on the clothes collision frequency and the clothes collision amplitude.

[0081] In an embodiment, the fan control module 404 is configured to start a heater and control the fan motor to rotate according to the target rotation speed value to drive the fan to provide the dry airflow for the clothes.

[0082] In an embodiment, the apparatus also includes a cooling module.

[0083] The cooling module is configured to determine whether a clothes cooling condition is satisfied; and in response to determining that the clothes cooling condition is satisfied, turn off the heater and control the fan motor to rotate according to a specified rotation speed value to drive the fan to provide cooling airflow for the clothes.

[0084] In an embodiment, multiple fans are provided, the fans are driven by the fan motor, and the fan control module 404 is configured to determine a target fan from the multiple fans; and control the fan motor to rotate according to the target rotation speed value to drive the target fan.

[0085] In an embodiment, the determination module 403 determines the target fan from the multiple fans by determining the target fan from the multiple fans according to at least one of the weight value or preset clothes drying duration.

[0086] It is to be known by those skilled in the art that for the sake of convenience and conciseness in description, the classification of the preceding function modules is provided as an example, and in practical applications, the preceding functions may be performed by different functional modules according to needs, that is, the internal structure of the apparatus is divided into different functional modules to perform all or part of the preceding functions. For the working process of the function modules, see the corresponding process in the preceding method embodiment. The details are not described here.

[0087] The apparatus of embodiments of the present application includes a drum driven by a drum motor and a fan driven by a fan motor, that is, double drives. The apparatus can control the drum motor to rotate according to a preset

rotation speed value to drive the drum; acquire the weight value of clothes in the drum; determine the target rotation speed value of the fan motor based on the weight value; and control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes. The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value. The clothes dryer in embodiments of the present application uses double drives. The drum and the fan of the clothes dryer are driven independently of each other. The drum may be driven by the drum motor while the fan may be driven by the fan motor. The rotation speed of the drum is independent of the rotation speed of the fan, offering flexibility in control and catering to a wider range of control requirements in various application scenarios. Moreover, the driving speed of the fan motor can be determined on site based on the weight of the clothes, ensuring that the rotation speed of the fan is better matched to the actual application scenario and thus enhancing the clothes drying effectiveness.

[0088] Embodiments of the present application also provide a clothes dryer. The clothes dryer includes a memory, a processor, and a computer program stored in the memory and executable on the processor. The processor is configured to, when executing the computer program, perform the method for controlling a clothes dryer according to any embodiment of the present application.

[0089] Embodiments of the present application also provide a computer-readable storage medium storing a computer program which, when executed by a processor, causes the processor to perform the method for controlling a clothes dryer according to any embodiment of the present application.

[0090] The storage medium may be a non-transitory storage medium.

[0091] FIG. 5 is a diagram illustrating the structure of a computer system 500 for performing the method for controlling a clothes dryer according to any embodiment of the present application. The clothes dryer of FIG. 5 is an example not intended to limit the function and application scope of embodiments of the present application.

[0092] As shown in FIG. 5, the computer system 500 includes a central processing unit (CPU) 501. The computer system 500 may execute various appropriate actions and processing according to a program stored in a read-only memory (ROM) 502 or a program loaded into a random access memory (RAM) 503 from a storage portion 508. Various programs and data required for operations of the computer system 500 may also be stored in the RAM 503. The CPU 501, the ROM 502, and the RAM 503 are connected to each other by a bus 504. An input/output (I/O) interface 505 is also connected to the bus 504.

[0093] The following components are connected to the I/O interface 505: an input portion 506 such as a keyboard or a mouse; an output portion 507 such as a cathode ray tube (CRT), a liquid crystal display (LCD), or a speaker; a storage portion 508 such as a hard disk; and a communication portion 509 of a network interface card such as a local area network (LAN) card or a modem. The communication portion 509 performs communication processing through a network such as the Internet. A drive 510 is also connected to the I/O interface 505 as required. A removable medium 511 such as a disk, an optical disc, a magneto-optical disc, or a semiconductor storage device is installed on the drive 510 as required, allowing a computer program read from the removable medium 511 to be installed into the storage portion 508 as required.

[0094] According to embodiments of the present application, the process described above with reference to the flowchart may be implemented as a computer software program. For example, this embodiment of the present application includes a computer program product. The computer program product includes a computer program carried in a computer-readable medium. The computer program includes program codes for performing the method shown in the flowchart. In such embodiments, the computer program may be downloaded from a network and installed through the communication portion 509 and/or may be installed through the storage portion 511. When the computer program is executed by the CPU 501, the preceding functions defined in the system of the present application are executed.

[0095] The computer-readable medium described above in the present application may be a computer-readable signal medium or a computer-readable storage medium or any combination thereof. The computer-readable storage medium, for example, may be, but is not limited to, an electrical, magnetic, optical, electromagnetic, infrared, or semiconductor system, apparatus, or device, or any combination thereof. The computer-readable storage medium may include, but is not limited to, an electrical connection having one or more wires, a portable computer disk, a hard disk, a random access memory (RAM), a read-only memory (ROM), an erasable programmable read-only memory (EPROM) or flash memory, an optical fiber, a portable compact disc read-only memory (CD-ROM), an optical memory device, a magnetic memory device, or any suitable combination thereof. In this application, the computer-readable storage medium may be any tangible medium including or storing a program. The program may be used by or used in conjunction with an instruction execution system, apparatus, or element. In embodiments of the present application, the computer-readable signal medium may include a data signal propagated on a base band or as part of a carrier. Computer-readable program codes are carried in the data signal. The data signal propagated in this manner may be in multiple forms and includes, and is not limited to, an electromagnetic signal, an optical signal, or any suitable combination thereof. The computer-readable signal medium may also be any computer-readable medium except the computer-readable storage medium. The computer-readable medium may send, propagate or transmit a program used by or used in conjunction with an instruction execution system, apparatus or device. The program codes included on the computer-readable medium may be trans-

mitted by using any suitable medium, including, but not limited to, a wireless medium, a wired medium, an optical cable, radio frequency (RF), and the like, or any suitable combination thereof.

[0096] The flowcharts and block diagrams in the drawings show the possible architecture, function and operation of the system, method and computer program product according to various embodiments of the present application. In this regard, each block in the flowcharts or block diagrams may represent a module, a program segment, or part of codes that contains one or more executable instructions for implementing specified logical functions. It is to be noted that in some alternative implementations, the functions marked in the blocks may occur in an order different from those marked in the drawings. For example, two successive blocks may, in fact, be executed substantially in parallel or in a reverse order, which depends on the functions involved. It is also to be noted that each block in the block diagrams or flowcharts and a combination of blocks in the block diagrams or flowcharts may be implemented by a special-purpose hardware-based system which executes specified functions or operations, or a combination of special-purpose hardware and computer instructions.

[0097] The modules and/or units involved in the embodiments of the present application may be implemented by software or hardware. The described modules and/or units can also be disposed in the processor. For example, the processor includes a drum control module, an acquisition module, a determination module, and a fan control module. The name of a module is not intended to limit the module in a certain circumstance.

[0098] In another aspect, the present application also provides a computer-readable medium. The computer-readable medium may be included in a device described in the preceding embodiments or may exist separately without being installed in the device. The computer-readable medium carries one or more programs. When the one or more programs are executed by the device, the device is configured to control the drum motor to rotate according to a preset rotation speed value to drive the drum; acquire the weight value of clothes in the drum; determine the target rotation speed value of the fan motor based on the weight value; and control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes. The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

[0099] The clothes dryer according to embodiments of the present application includes a drum driven by a drum motor and a fan driven by a fan motor, that is, double drives. The clothes dryer can control the drum motor to rotate according to a preset rotation speed value to drive the drum; acquire the weight value of clothes in the drum; determine the target rotation speed value of the fan motor based on the weight value; and control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes. The larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value. On other words, the clothes dryer of embodiments of the present application uses double drives. The drum and the fan of the clothes dryer are driven independently of each other. The drum can be driven by the drum motor while the fan can be driven by the fan motor. The rotation speed of the drum is independent of the rotation speed of the fan, offering flexibility in control and catering to a wider range of control requirements in various application scenarios. Moreover, the driving speed of the fan motor can be determined on site based on the weight of the clothes, ensuring that the rotation speed of the fan is better matched to the actual application scenario and thus enhancing the clothes drying effectiveness.

[0100] It is to be understood by those skilled in the art that various modifications, combinations, subcombinations, and substitutions may be made to embodiments of the present application according to design requirements and other factors.

Claims

1. A method for controlling a clothes dryer, wherein the clothes dryer comprises a drum driven by a drum motor and a fan driven by a fan motor, and the method comprises:

   controlling the drum motor to rotate according to a preset rotation speed value to drive the drum;
   acquiring a weight value of clothes in the drum;
   determining a target rotation speed value of the fan motor based on the weight value; and
   controlling the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes,
   wherein the larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

2. The method of claim 1, wherein the weight value of the clothes comprises an initial weight value of the clothes;

   determining the target rotation speed value of the fan motor based on the weight value comprises determining a fixed target rotation speed value of the fan motor based on the initial weight value; and
   controlling the fan motor to rotate according to the target rotation speed value to drive the fan comprises

controlling the fan motor to rotate at a fixed speed according to the fixed target rotation speed value to drive the fan.

3. The method of claim 1, wherein the weight value of the clothes comprises a real-time weight value of the clothes;

determining the target rotation speed value of the fan motor based on the weight value comprises determining a real-time target rotation speed value of the fan motor based on the real-time weight value; and
controlling the fan motor to rotate according to the target rotation speed value to drive the fan comprises controlling the fan motor to rotate at a variable speed according to the real-time target rotation speed value to drive the fan.

4. The method of claim 1, wherein controlling the drum motor to rotate according to the preset rotation speed value to drive the drum comprises:
controlling the drum motor to rotate according to the preset rotation speed value to drive the drum to rotate forwards and backwards.

5. The method of claim 4, wherein controlling the drum motor to rotate according to the preset rotation speed value to drive the drum to rotate forwards and backwards comprises:
controlling the drum motor to rotate according to the preset rotation speed value to drive the drum to rotate forwards and backwards for a same duration.

6. The method of claim 1, wherein determining the target rotation speed value of the fan motor based on the weight value comprises:

determining the target rotation speed value of the fan motor based on the weight value by using a preset function, wherein the preset function comprises a linear function or a quadratic function,
an independent variable of the preset function is a weight, and a dependent variable of the preset function is a rotation speed.

7. The method of claim 1, wherein acquiring the weight value of the clothes in the drum comprises:

acquiring at least one of load power of the drum motor or load current of the drum motor; and
determining the weight value of the clothes based on the at least one of the load power or the load current.

8. The method of claim 1, wherein acquiring the weight value of the clothes in the drum comprises:

acquiring a clothes collision frequency and a clothes collision amplitude that are detected by a clothes sensor in the drum; and
determining the weight value of the clothes based on the clothes collision frequency and the clothes collision amplitude.

9. The method of claim 1, wherein controlling the fan motor to rotate according to the target rotation speed value to drive the fan to provide the dry airflow for the clothes comprises:
starting a heater and controlling the fan motor to rotate according to the target rotation speed value to drive the fan to provide the dry airflow for the clothes.

10. The method of claim 9, further comprising:

determining whether a clothes cooling condition is satisfied; and
in response to the clothes cooling condition being satisfied, turning off the heater and
controlling the fan motor to rotate according to a specified rotation speed value to drive the fan to provide cooling airflow for the clothes.

11. The method of claim 1, wherein a plurality of fans are provided, the plurality of fans are driven by the fan motor, and controlling the fan motor to rotate according to the target rotation speed value to drive the fan further comprises:

determining a target fan from the plurality of fans; and
controlling the fan motor to rotate according to the target rotation speed value to drive the target fan.

12. The method of claim 11, wherein determining the target fan from the plurality of fans comprises:

determining, according to at least one of the weight value or a preset clothes drying duration, the target fan from the plurality of fans.

13. An apparatus for controlling a clothes dryer, wherein the clothes dryer comprises a drum driven by a drum motor and a fan driven by a fan motor, and the apparatus comprises:

a drum control module configured to control the drum motor to rotate according to a preset rotation speed value to drive the drum;
an acquisition module configured to acquire a weight value of clothes in the drum;
a determination module configured to determine a target rotation speed value of the fan motor based on the weight value; and
a fan control module configured to control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes,
wherein the larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value.

14. A clothes dryer, comprising a memory, a processor, and a computer program stored in the memory and executable on the processor, wherein the processor is configured to, when executing the computer program, perform the method for controlling the clothes dryer according to any one of claims 1 to 12.

15. A computer-readable storage medium storing a computer program which, when executed by a processor, causes the processor to perform the method for controlling the clothes dryer according to any one of claims 1 to 12.

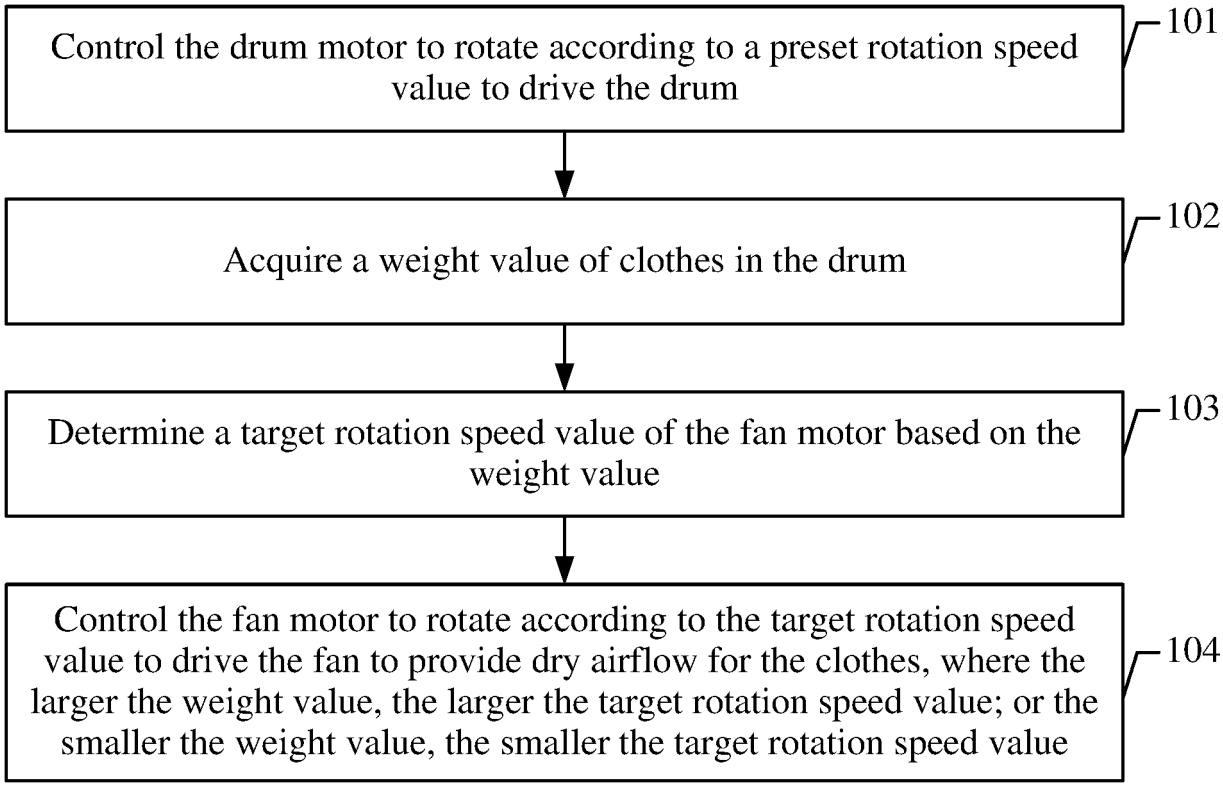
Control the drum motor to rotate according to a preset rotation speed value to drive the drum
101
Acquire a weight value of clothes in the drum
102
Determine a target rotation speed value of the fan motor based on the weight value
103
Control the fan motor to rotate according to the target rotation speed value to drive the fan to provide dry airflow for the clothes, where the larger the weight value, the larger the target rotation speed value; or the smaller the weight value, the smaller the target rotation speed value
104

FIG. 1

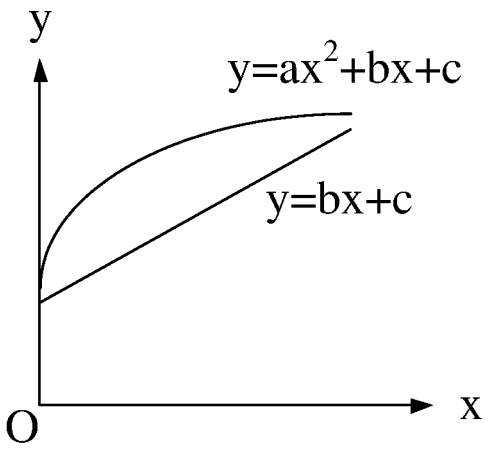
y
y=ax²+bx+c
y=bx+c
O
x

FIG. 2

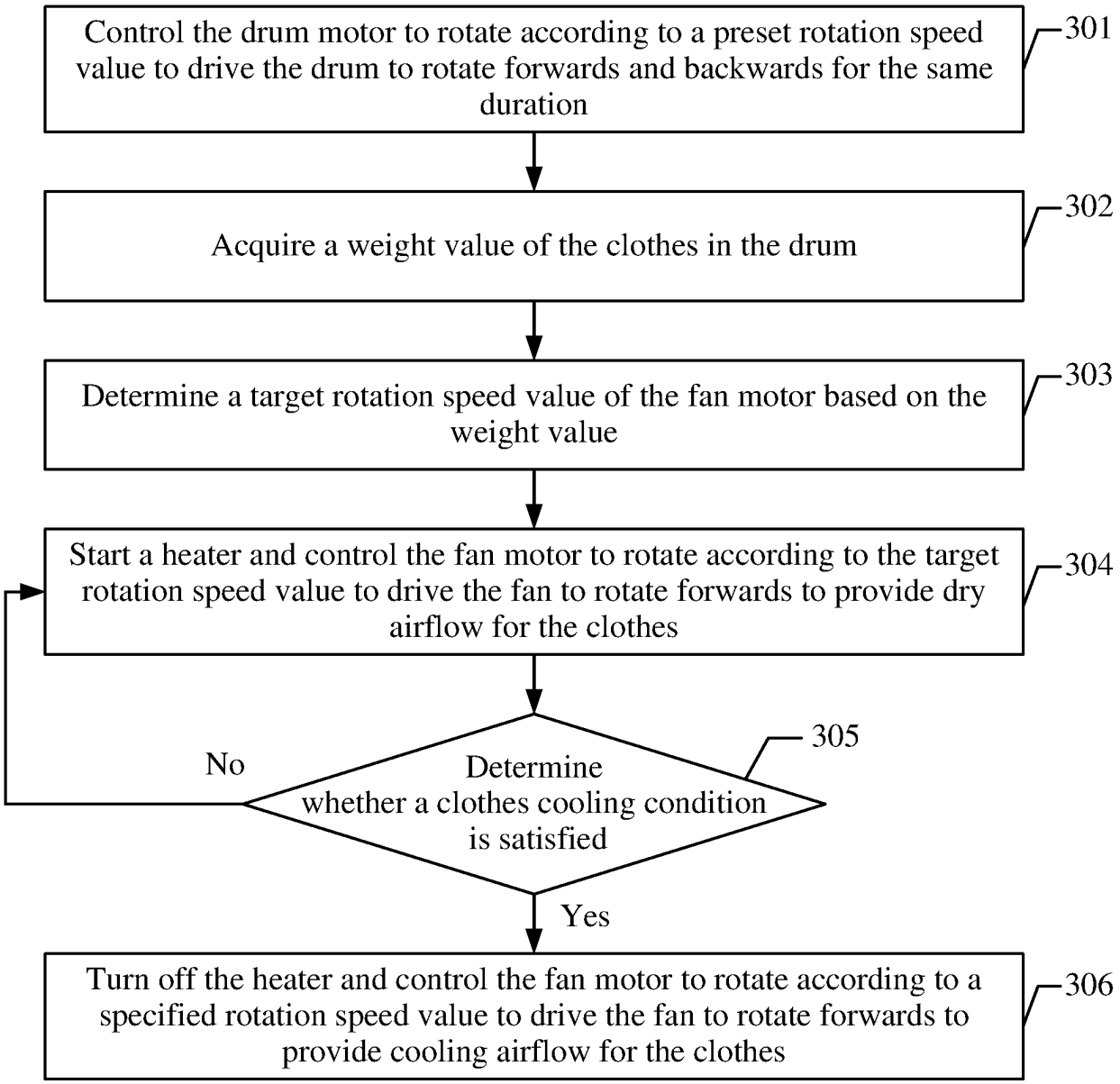
Control the drum motor to rotate according to a preset rotation speed value to drive the drum to rotate forwards and backwards for the same duration
301
Acquire a weight value of the clothes in the drum
302
Determine a target rotation speed value of the fan motor based on the weight value
303
Start a heater and control the fan motor to rotate according to the target rotation speed value to drive the fan to rotate forwards to provide dry airflow for the clothes
304
Determine whether a clothes cooling condition is satisfied
305
No
Yes
Turn off the heater and control the fan motor to rotate according to a specified rotation speed value to drive the fan to rotate forwards to provide cooling airflow for the clothes
306

FIG. 3

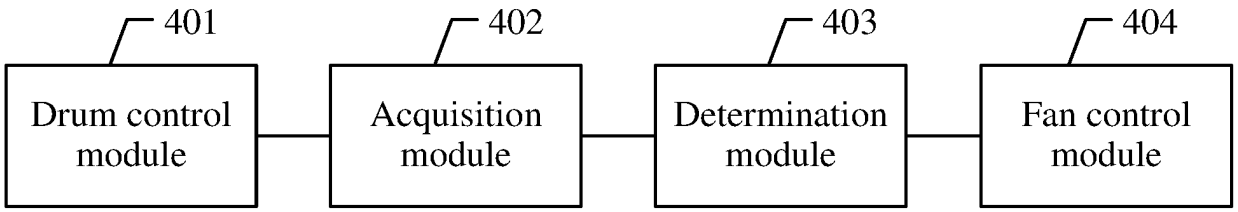
401
Drum control module
402
Acquisition module
403
Determination module
404
Fan control module

FIG. 4

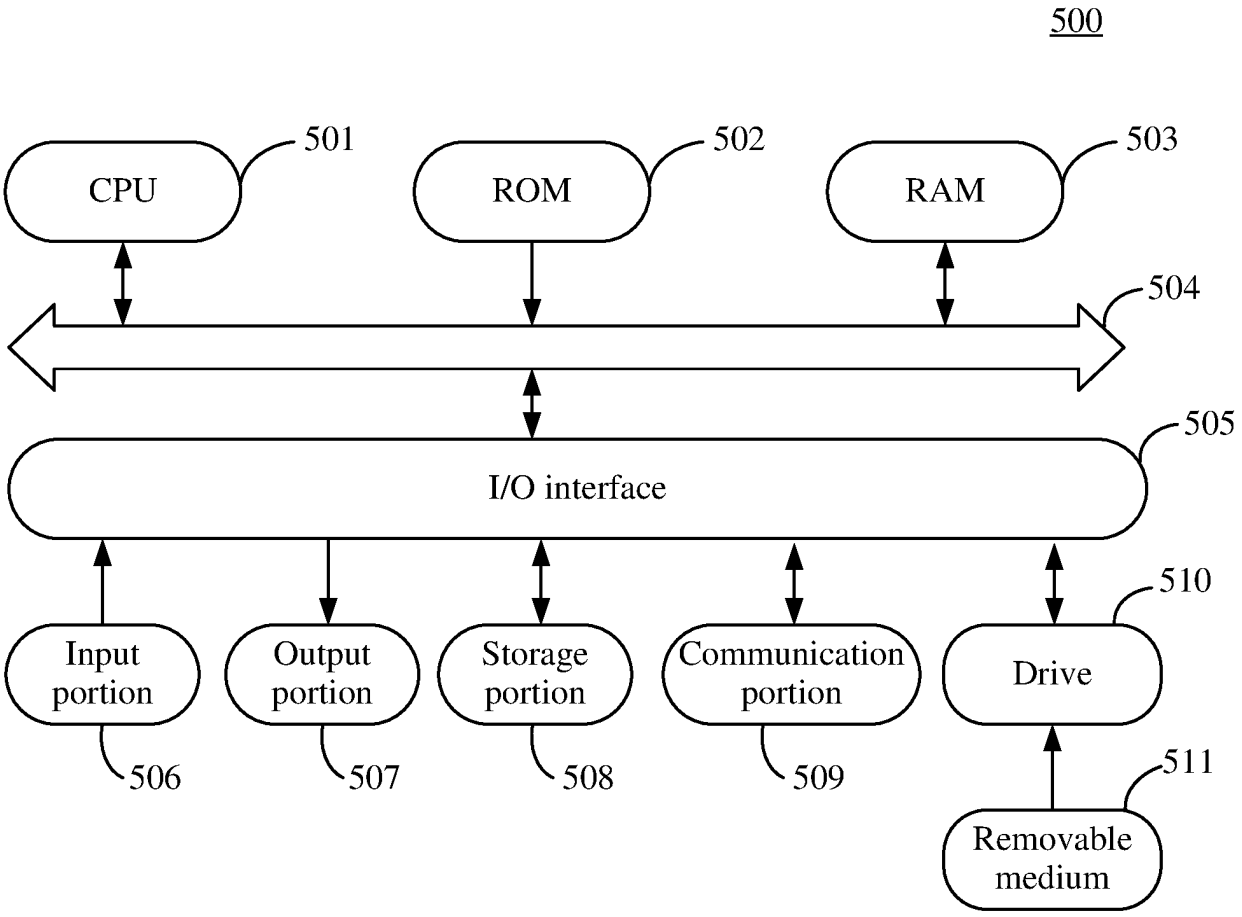
500
CPU
501
ROM
502
RAM
503
504
I/O interface
505
Input portion
506
Output portion
507
Storage portion
508
Communication portion
509
Drive
510
Removable medium
511

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/131328

A. CLASSIFICATION OF SUBJECT MATTER

D06F58/38(2020.01)i;D06F58/34(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)

CNTXT, VEN, WPABSC, WPABS, ENTXTC, ENTXT, CNKI: 布量, 重量, 负载量, 衣物量, 电动机, 电机, 马达, 驱动, 速度, 转速, 转数, 风扇, 风机, 功率, 滚筒, 海尔, 碰撞, 接触, 幅度, 程度, 频次, blower, fan, load, motor, speed, weight, drive???, revolv+, ventilat+, rotat+, blade?, Collision, contact+, amplitude, power

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CN 112095309 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 18 December 2020 (2020-12-18) description, paragraphs [0025]-[0099], and figures 1-5	1-7, 9-10, 13-15
Y	CN 112095309 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD. et al.) 18 December 2020 (2020-12-18) description, paragraphs [0025]-[0099], and figures 1-5	11-12,
Y	CN 202671922 U (LYU XING) 16 January 2013 (2013-01-16) description, paragraph [0018], and figures 3-4	11-12,
PX	CN 114438761 A (QINGDAO HAIER WASHING ELECTRIC APPLIANCE CO., LTD. et al.) 06 May 2022 (2022-05-06) claims 1-15	1-15
A	JP 2016052395 A (TOSHIBA CORP., et al.) 14 April 2016 (2016-04-14) entire document	1-15

☑ 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
"D" document cited by the applicant in the international application
"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
27 January 2023	**08 February 2023**
Name and mailing address of the ISA/CN **China National Intellectual Property Administration (ISA/CN)** **China No. 6, Xitucheng Road, Jimenqiao, Haidian District, Beijing 100088** Facsimile No. **(86-10)62019451**	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2022/131328

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 104838056 A (ELECTROLUX HOME PRODUCTS CORPORATION N.V.) 12 August 2015 (2015-08-12) entire document	1-15
A	CN 104812954 A (ELECTROLUX HOME PRODUCTS CORPORATION N.V.) 29 July 2015 (2015-07-29) entire document	1-15
A	CN 113638208 A (MORUS INTELLIGENT TECHNOLOGY SHENZHEN CO., LTD.) 12 November 2021 (2021-11-12) entire document	1-15
A	KR 20190046599 A (SAMSUNG ELECTRONICS CO., LTD.) 07 May 2019 (2019-05-07) entire document	1-15

Form PCT/ISA/210 (second sheet) (July 2022)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/131328

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)			Publication date (day/month/year)
CN	112095309	A	18 December 2020	None			
CN	202671922	U	16 January 2013	None			
CN	114438761	A	06 May 2022	None			
JP	2016052395	A	14 April 2016	JP	6486037	B2	14 April 2016
CN	104838056	A	12 August 2015	AU	2013349694	A1	04 June 2015
				US	2015299934	A1	22 October 2015
				US	9534340	B2	22 October 2015
				EP	2922993	A1	30 September 2015
				EP	2922993	B1	30 September 2015
				WO	2014079934	A1	30 May 2014
				BR	112015011965	A2	15 May 2018
				BR	112015011965	B1	15 May 2018
				EP	2735642	A1	28 May 2014
CN	104812954	A	29 July 2015	BR	112015011966	A2	03 October 2017
				EP	2922992	A1	30 September 2015
				EP	2922992	B1	30 September 2015
				EP	2735643	A1	28 May 2014
				US	2015322619	A1	12 November 2015
				US	9758921	B2	12 November 2015
				AU	2013349825	A1	04 June 2015
				WO	2014079800	A1	30 May 2014
CN	113638208	A	12 November 2021	None			
KR	20190046599	A	07 May 2019	EP	3669023	A1	24 June 2020
				EP	3669023	A4	24 June 2020
				EP	3669023	B1	24 June 2020

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- CN 202111503663 **[0001]**