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(54) **CONTROL METHOD FOR WASHING MACHINE**

(57) A control method for a washing machine is provided. The washing machine includes a housing (1); an inner drum (5) disposed inside the housing (1) and provided with a washing cavity independently holding washing water; and an electromagnetic heating device disposed inside the housing (1), and used for correspondingly heating a side wall of the inner drum (5); and the control method includes controlling the electromagnetic heating device to start heating the inner drum (5) when the washing machine performs a last rinsing program and/or a dewatering program. The control method for the washing machine achieves thermal dewatering of clothes, the electromagnetic heating device heats the inner drum (5), and the clothes have lower moisture content, which is convenient for rapid airing/drying in the sun/oven drying, and improves the use experience of users.

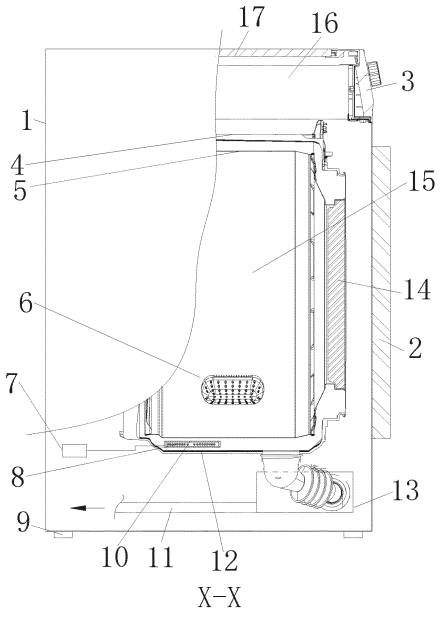

Fig. 2

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Description

TECHNICAL FIELD

[0001] The present disclosure relates to the technical field of laundry equipment, in particular to a control method for a washing machine.

BACKGROUND

[0002] As a most widely used household appliance in daily life of people, a washing machine helps people get rid of the trouble of washing clothes and brings great convenience to people. However, an existing washing machine generally includes an inner drum and an outer drum, and a plurality of dewatering holes are formed in the wall of the inner drum. During the washing process, washing water between the inner drum and the outer drum cannot be used, thus causing waste of this part of washing water, and dirt generated during the washing process will enter a position between the inner drum and the outer drum along with a water flow, and is accumulated. With long-term use, the accumulation of the dirt will affect the washing effect and reduce the user experience.

[0003] In order to solve the above problems, some patents, such as a Chinese disclosure patent with an application number of 201410215346.3 and a name of a drum washing machine, have also been put forward, the disclosure relates to a drum washing machine which includes a box body, an inner drum and an outer drum are arranged in the box body, a door seal is arranged between the outer drum and the box body, and the inner drum is connected with a driving device. The inner drum is a non-porous inner drum, the inner drum is a conical drum with a small diameter at the drum bottom and a large diameter at a drum opening, the drum opening of the inner drum is folded inwards in an arc shape, a water inlet guide pipe is arranged on the door seal, one end of the water inlet guide pipe is connected with a washing water rapid heating device, and the other end of the water inlet guide pipe penetrates through the door seal and extends into the inner drum. The outer drum is provided with a water outlet and a water pressure detection device. According to the above technical solution, the inner drum in the disclosure is a non-porous inner drum, water feeding of the inner drum is achieved through the water inlet guide pipe arranged on the door seal, water discharging is achieved in the dewatering process through the shape of the inner drum itself, and therefore water can be prevented from being stored between the inner drum and the outer drum, and the washing water consumption is greatly reduced.

[0004] The above described disclosure provides a drum washing machine with a non-porous inner drum, solving the problems of waste of water stored between the inner drum and the outer drum and accumulation of dirt between the inner drum and the outer drum, however, a conventional washing machine requires some functional elements to be arranged on the outer drum, reducing the functionality of the washing machine with the non-porous inner drum. For example, most existing washing machines achieve washing water heating by providing a heating tube within the outer drum to improve the washing effect, while the washing machine with the non-porous inner drum cannot be provided with the heating tube on the outer drum, and thus the washing machine cannot achieve heating washing. Heating washing is very important to improve the washing effect, and is increasingly used by a wide range of users.

[0005] In order to solve the problem of heating washing of the washing machine with the non-porous inner drum, Chinese disclosure patent Application No. 201811191414. 1, entitled Drum Washing Machine, discloses a drum washing machine including a non-porous drum without dewatering holes mounted in a housing, wherein a clothes dosing opening is formed in a side wall of the non-porous drum, and a door body that is reversible to open and close the clothes dosing opening is arranged on the drum; an outer drum sleeves the drum, and an electromagnetic heating module is arranged on the outer drum to heat the inside of the outer drum and transfer the heat to washing water contained in the drum. By arranging the electromagnetic heating module described above on the outer drum, the drum inside the outer drum and washing water inside the drum are subjected to heating treatment with an electromagnetic field, thereby achieving the use purpose of adjusting the temperature of the washing water inside the drum of the washing machine.

[0006] The above disclosure patent application can achieve heating of washing water in the drum washing machine with the non-porous inner drum by means of electromagnetic heating, but a dewatering effect of the non-porous inner drum is not as good as that of a porous inner drum, resulting in high moisture content of clothes and poor washing effects.

[0007] In view of this, the present disclosure is particularly proposed for how to reduce the moisture content of clothes washed by the washing machine with the non-porous inner drum.

SUMMARY

[0008] In order to solve the above problems, the present disclosure aims to provide a control method for a washing machine with a self-cleaning function which can reduce the water content of washed clothes, and in particular, the following technical solution is adopted:

A control method of a washing machine is provided. The washing machine includes a housing; an inner drum disposed inside the housing and provided with a washing cavity independently holding washing water; and an electromagnetic heating device disposed inside the housing, and used for correspondingly heating a side wall of the inner drum; and the control method includes controlling

the electromagnetic heating device to start heating the inner drum when the washing machine performs a last rinsing program and/or a dewatering program.

[0009] Further, the dewatering program of the washing machine includes an accelerated dewatering phase in which a rotating speed of the inner drum gradually increases and a stable dewatering phase in which a rotating speed of the inner drum remains unchanged, and the washing machine controls the electromagnetic heating device to start heating the inner drum at least during the accelerated dewatering phase.

[0010] Further, the washing machine controls the electromagnetic heating device to remain operated throughout the accelerated dewatering phase and to be turned off when entering the stable dewatering phase.

[0011] Further, the washing machine controls the electromagnetic heating device to be operated at intervals at a set time interval during the stable dewatering phase.

[0012] Further, the stable dewatering phase includes a low-speed stable dewatering phase and a high-speed stable dewatering phase, and the washing machine controls the electromagnetic heating device to be operated at intervals at a first set time interval T1 during the low-speed stable dewatering phase and to be operated at intervals at a second set time interval T2 during the high-speed stable dewatering phase, the second set time interval T2 being greater than or equal to the first set time interval T 1.

[0013] Further, an electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls a heating power of the electromagnetic heating device during the accelerated dewatering phase to be greater than a heating power during the stable dewatering phase; and

preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a first heating power P1 during the low-speed stable dewatering phase, heat the inner drum at a second heating power P2 during the accelerated dewatering phase, and heat the inner drum at a third heating power P3 during the high-speed stable dewatering, the second heating power P2 being greater than the first heating power P1 which is greater than or equal to the third heating power P3.

[0014] Further, the last rinsing program of the washing machine includes a rinsing water inlet phase, a rinsing washing phase, and a rinsing drainage phase, and the washing machine controls the electromagnetic heating device to be operated at least during the rinsing drainage phase.

[0015] Further, drainage holes are formed in the side wall of the inner drum, and centrifugal drainage mechanisms for controlling opening and closing of the drainage holes are mounted in the drainage holes, the centrifugal drainage mechanisms maintain the drainage holes in a normally closed condition, and the centrifugal drainage mechanisms enable the drainage holes to be opened by a centrifugal force from the rotation of the inner drum when the rotating speed of the inner drum reaches V0; and

when the washing machine performs the last rinsing program, the inner drum is controlled to rotate at a rotating speed of V0, the washing machine enters the rinsing drainage phase, the electromagnetic heating device is controlled to be operated, and the electromagnetic heating device is controlled to be turned off when the inner drum continuously rotates at the rotating speed of V0 for a set time of T0.

[0016] Further, the electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls a heating power of the electromagnetic heating device during the rinsing drainage phase to be greater than heating powers during other rinsing phases; and

preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a fourth heating power P4 in the rinsing water inlet phase, and heat the inner drum at a fifth heating power P5 in the rinsing drainage phase, the fourth heating power P4 being smaller than or equal to the fifth heating power P5.

[0017] Further, the electromagnetic heating power of the electromagnetic heating device is adjustable, and a main controller of the washing machine stores a correspondence between a clothes load interval of the washing machine and the electromagnetic heating power:

when the washing machine detects that a clothes load is in a corresponding clothes load interval, the washing machine controls the electromagnetic heating device for heating with an electromagnetic heating power corresponding to this load interval.

[0018] The present disclosure provides a washing machine, which can greatly reduce the washing water consumption of the washing machine without filling washing/rinsing water between the inner drum and the outer drum. The possibility of dirt adhesion between the inner drum and the outer drum is avoided. The user health and the user experience are greatly improved, and water resources are greatly saved. In addition, the washing machine of the present disclosure utilizes the electromagnetic heating device to achieve contactless heating of the inner drum and thereby heat washing water inside the inner drum to achieve a heating washing function of a washing machine with a non-porous inner drum to improve the clothes washing effect.

[0019] The control method for the washing machine of the present disclosure includes controlling the electromagnetic heating device to start heating the inner drum when the washing machine performs the last rinsing program and/or the dewatering program. In the present disclosure, thermal dewatering of clothes is achieved, the electromagnetic heating device heats the inner drum, and the clothes have lower moisture content, which is convenient for rapid airing/drying in the sun/oven drying, and improves the use experience of users.

BRIEF DESCRIPTION OF THE DRAWINGS

[0020]

Fig. 1 is a front view of a washing machine of the present disclosure;
Fig. 2 is a cross-sectional view along a plane X-X of Fig. 1; and
Fig. 3 is another cross-sectional view along the plane X-X of Fig. 1.

[0021] Description of reference signs: 1, housing; 2, door; 3, main controller; 4, outer drum; 5, inner drum; 6, lifting rib; 7, electromagnetic heating driver; 8, electromagnetic heating coil; 9, bottom leg; 10, encapsulating structure; 11, drain pipe; 12, magnetic strip; 13, drainage device; 14, inner drum door; 15, sealed compartment structure; 16, detergent dosing box; 17, upper deck plate; and 18, electromagnetic induction coil.

DETAILED DESCRIPTION

[0022] A control method for a washing machine of the present disclosure will be described below in detail in conjunction with the accompanying drawings:

Embodiment 1

[0023] A washing machine in this embodiment includes a housing; an inner drum disposed within the housing and provided with a washing cavity independently holding washing water; and an electromagnetic heating device disposed within the housing and used for correspondingly heating a side wall of the inner drum.

[0024] This embodiment provides a washing machine, which can greatly reduce the washing water consumption of the washing machine without filling washing/rinsing water between the inner drum and an outer drum. The possibility of dirt adhesion between the inner drum and the outer drum is avoided. The user health and the user experience are greatly improved, and water resources are greatly saved. In addition, the washing machine in this embodiment utilizes the electromagnetic heating device to achieve contactless heating of the inner drum and thereby heat washing water inside the inner drum to achieve a heating washing function of a washing machine with a non-porous inner drum to improve the clothes washing effect.

[0025] An outer drum is disposed within the housing of the washing machine in this embodiment, the inner drum is disposed within the outer drum, and the electromagnetic heating device is disposed on a side wall of the outer drum; or, the housing of the washing machine in this embodiment is not provided with an outer drum, and the electromagnetic heating device is directly arranged on the inner wall of the housing, and is opposite to the side wall of the inner drum.

[0026] A control method for the washing machine in this embodiment includes controlling the electromagnetic heating device to start heating the inner drum when the washing machine performs a last rinsing program and/or a dewatering program. This embodiment achieves thermal dewatering of clothes, the electromagnetic heating device heats the inner drum, and the clothes have lower moisture content, which is convenient for rapid airing/drying in the sun/oven drying, and improves the use experience of users.

[0027] Further, the dewatering program of the washing machine in this embodiment includes an accelerated dewatering phase in which a rotating speed of the inner drum gradually increases and a stable dewatering phase in which a rotating speed of the inner drum remains unchanged, and the washing machine controls the electromagnetic heating device to start heating the inner drum at least during the accelerated dewatering phase.

[0028] When the washing machine in this embodiment performs the dewatering program, the inner drum rotates centrifugally at a high speed, thus forming a "centrifuge thin water layer" on the wall of the inner drum, at this time, the electromagnetic heating device is controlled to start heating the inner drum to achieve a high temperature of about 100°C for the inner drum, and the wet clothes are heated and dried to reduce the water content.

[0029] The control method for the washing machine in this embodiment controls the electromagnetic heating device to start heating the inner drum during the accelerated dewatering phase of the dewatering program, for example, electromagnetic heating is stopped when the rotating speed is stabilized at 600 revolutions, and electromagnetic heating is conducted in the process that the rotating speed starts to increase to 800 revolutions; electromagnetic heating is stopped when the rotating speed is stabilized at 800 revolutions, and electromagnetic heating is conducted in the process that the rotating speed starts to increase to 1000 revolutions; electromagnetic heating is stopped when the rotating speed is stabilized at 1000 revolutions, and electromagnetic heating is conducted in the process that the rotating speed starts to increase to 1200 revolutions; and electromagnetic heating is stopped when the rotating speed is stabilized at 1200 revolutions, and electromagnetic heating is conducted in the process that the rotating speed starts to increase to 1400 revolutions. In the steady state of rotating speed, there are few "centrifugal thin water layers", which avoids an electromagnetic module heating the inner drum to too high a temperature to damage the clothes.

[0030] As one implementation of this embodiment, the washing machine controls the electromagnetic heating device to remain operated throughout the accelerated dewatering phase and to be turned off when entering the stable dewatering phase.

[0031] As another implementation of this embodiment, the washing machine controls the electromagnetic heating device to be operated at intervals at a set time interval during the stable dewatering phase. By means of heating

at intervals, energy losses can be avoided and the water content of the clothes can be reduced to a certain extent due to few "centrifugal thin water layers" in the stable dewatering phase.

[0032] In particular, the stable dewatering phase includes a low-speed stable dewatering phase and a high-speed stable dewatering phase, and the washing machine controls the electromagnetic heating device to be operated at intervals at a first set time interval T1 during the low-speed stable dewatering phase and to be operated at intervals at a second set time interval T2 during the high-speed stable dewatering phase, the second set time interval T2 being greater than or equal to the first set time interval T 1.

[0033] As an implementation of this embodiment, an electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls a heating power of the electromagnetic heating device during the accelerated dewatering phase to be greater than a heating power during the stable dewatering phase.

[0034] Preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a first heating power P1 during the low-speed stable dewatering phase, heat the inner drum at a second heating power P2 during the accelerated dewatering phase, and heat the inner drum at a third heating power P3 during the high-speed stable dewatering, the second heating power P2 being greater than the first heating power P1 which is greater than or equal to the third heating power P3.

[0035] As one implementation of this embodiment, the last rinsing program of the washing machine in this embodiment includes a rinsing water inlet phase, a rinsing washing phase, and a rinsing drainage phase, and the washing machine controls the electromagnetic heating device to be operated at least during the rinsing drainage phase. In this embodiment, the electromagnetic heating device is controlled to start heating the inner drum during rinsing, and the dewatering program is entered after the clothes is heated to achieve the "thermal dewatering" effect, thereby enhancing the dewatering effect and further reducing the moisture content of the clothes.

[0036] Further, drainage holes are formed in the side wall of the inner drum, and centrifugal drainage mechanisms for controlling opening and closing of the drainage holes are mounted in the drainage holes, the centrifugal drainage mechanisms maintain the drainage holes in a normally closed condition, and the centrifugal drainage mechanisms enable the drainage holes to be opened by centrifugal force from the rotation of the inner drum when the rotating speed of the inner drum reaches V0.

[0037] When the washing machine performs the last rinsing program, the inner drum is controlled to rotate at a rotating speed of V0, the washing machine enters the rinsing drainage phase, the electromagnetic heating device is controlled to be operated, and the electromagnetic heating device is controlled to be turned off when the inner drum continuously rotates at the rotating speed of V0 for a set time of T0. During the rinsing drainage phase of the washing machine, a "centrifuge thin water layer" is formed on the wall of the inner drum, at this time, the electromagnetic heating device is controlled to start heating the inner drum to achieve a high temperature of about 100°C for the inner drum, and the wet clothes are heated and dried to further reduce the water content.

[0038] Further, the electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls a heating power of the electromagnetic heating device during the rinsing drainage phase to be greater than heating powers during other rinsing phases.

[0039] Preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a fourth heating power P4 in the rinsing water inlet phase, and heat the inner drum at a fifth heating power P5 in the rinsing drainage phase, the fourth heating power P4 being smaller than or equal to the fifth heating power P5.

[0040] As one implementation of this embodiment, the electromagnetic heating power of the electromagnetic heating device is adjustable, and a main controller of the washing machine stores a correspondence between a clothes load interval of the washing machine and the electromagnetic heating power:

when the washing machine detects that a clothes load is in a corresponding clothes load interval, the washing machine controls the electromagnetic heating device for heating with an electromagnetic heating power corresponding to this load interval.

Embodiment 2

[0041] As shown in Figs. 1 and 2, this embodiment provides a washing machine, including: an outer drum 4; an inner drum 5 disposed within the outer drum 4; an electromagnetic heating coil 8 disposed on the outer drum 4; and an electromagnetic heating driver 7 electrically connected to the electromagnetic heating coil 8, wherein the electromagnetic heating driver 7 rectifies an alternating current into a direct current, and then converts the direct current to a high-frequency alternating current; and the electromagnetic heating driver 7 outputs the high-frequency alternating current to the electromagnetic heating coil 8, thereby generating a high-frequency alternating magnetic field in which the inner drum 5 is heated due to an induction eddy current generated by electromagnetic induction, heating water inside the inner drum 5.

[0042] A heating/drying program of the washing machine in this embodiment is operated, the current and voltage are converted into a direct current through the electromagnetic heating driver 7, so that the direct current is converted into a high-frequency alternating current that exceeds the audio frequency, and the high-frequency alternating current with a frequency of 0-100 KHz is output onto the electromagnetic heating coil 8, thereby

generating a high-frequency alternating magnetic field; its electromagnetic induction lines act on the inner drum made of a metal material, a strong eddy current is generated in the metal inner drum due to electromagnetic induction, the conversion from electric energy to heat energy is completed when the eddy current flows against the internal resistance of the inner drum, realizing the heating of the inner drum, and heating of the water inside the inner drum.

[0043] Preferably, the washing machine in this embodiment is a drum washing machine provided with a non-porous inner drum of a front-opening structure, and is simple in structure, and the washing water consumption of the washing machine can be greatly reduced without filling washing/rinsing water between the inner drum and the outer drum. The possibility of dirt adhesion between the inner drum and the outer drum is avoided. The user health and the user experience are greatly improved, and water resources are greatly saved.

[0044] The washing machine in this embodiment employs the non-porous inner drum, the inner drum independently holds washing water during washing, heating of washing water for the washing machine provided with the non-porous inner drum cannot achieved by a resistance wire heating mode of a conventional washing machine, and since the inner drum needs to rotate during the washing process, it is also not possible to provide a heating device within the inner drum to heat water inside the inner drum, so for the washing machine provided with the non-porous inner drum in this embodiment, a side wall of the inner drum 5 is heated by the electromagnetic heating coil 8, and then the heat is transferred to washing water inside the inner drum 5, thereby realizing heating of the washing water.

[0045] In addition, because of a resistance wire heating mode adopted by the existing washing machine, a resistance wire is immersed in water for direct heating, due to the fact that the water environment is complex, scales deposit on the resistance wire along with the increase of time, and the resistance wire is not easy to clean due to the mounting position, so that the heating efficiency is gradually reduced, and even damage is caused. In this embodiment, an electromagnetic heating device is adopted to achieve non-contact heating, so that the above problem can be solved, the service life is greatly prolonged, and long-term high-efficiency heating can be kept.

[0046] In order to achieve electromagnetic heating, the inner drum in this embodiment is made of a ferrous material and can cut alternating magnetic lines generated by the electromagnetic heating coil 8 to generate an alternating current (i.e. an eddy current), the eddy current enables carriers on the side wall of the inner drum to move irregularly at a high speed, and the carriers collide and rub against each other to generate thermal energy to heat the water inside the inner drum.

[0047] As one implementation of this embodiment, the electromagnetic heating coil 8 in this embodiment is disposed on an inner face of a peripheral side wall of the outer drum 4, the electromagnetic heating coil 8 is encapsulated by an encapsulating structure 10 made of an insulating material, and the encapsulating structure 10 has a connection structure for connection with the outer drum.

[0048] In this embodiment, the electromagnetic heating coil 8 is a high-frequency resonance coil that is wound by a copper wire in concentric circles, and the electromagnetic heating coil 8 is encapsulated by the encapsulating structure 10 to avoid the contact of water with an electromagnetic induction coil 18, thus improving the reliability and safety.

[0049] As one implementation of this embodiment, the back of the electromagnetic heating coil 8 and the back of the electromagnetic induction coil 18 in this embodiment are provided with a plurality of magnetic strips 12 to absorb magnetic induction lines and reduce leakage of the magnetic induction lines.

[0050] As one implementation of this embodiment, the washing machine in this embodiment further includes a resonant circuit electrically connected to the electromagnetic heating driver, and a temperature detection circuit coupled to the resonant circuit. In this embodiment, the current of the electromagnetic heating driver 7 is detected for feedback to determine the temperature of the water inside the inner drum 5 through the temperature detection circuit.

[0051] As one implementation of this embodiment, the outer drum 4 in this embodiment is provided with a positioning device, the positioning device is provided with retractable positioning posts, the inner drum 5 is provided with positioning holes for matching with the positioning posts, and the positioning posts of the positioning device extend out and are matched with the positioning holes to lock the inner drum 5. In this embodiment, the inner drum 5 is locked by the positioning device, in combination with a temperature measurement method of detecting the current of the electromagnetic heating driver 7 for feedback to determine the temperature of the water inside the inner drum 5, so that the accuracy of temperature measurement can be improved.

[0052] The drum washing machine in this embodiment is provided with a housing 1 including an upper deck plate 17, a front panel, a rear panel and a bottom plate. Bottom legs 9 are fixedly mounted on the bottom plate and used for supporting the whole washing machine. The outer drum 4 is arranged in the housing 1, and the inner drum 5 is coaxially arranged in the outer drum 4. The outer drum 4 is mainly used for collecting drained water of the inner drum 5 and drained water caused by high-speed centrifugal dewatering of the inner drum 5. The inner drum 5 rotates, and preferably, lifting ribs 6 are arranged to continuously lift clothes, make the clothes drop off and beat the clothes, so that the clothes are washed conveniently clean. The inner drum 5 is of a non-porous structure, and the outer drum 4 is provided with a central mounting hole to which bearings are fixed. An inner drum

shaft, which is in tight connection with the inner drum 5, passes through the bearings shown and is connected with a driving motor. A drum opening at the front part of the inner drum 5 is provided with an openable/closable inner drum door 14, thereby realizing that the inner drum 5 is a sealed compartment structure 15.

[0053] In order to achieve water inlet into the non-porous inner drum in this embodiment, the driving motor of the drum washing machine in this embodiment is in transmission connection with the inner drum 5 through the inner drum shaft to drive the inner drum 5 to rotate, a hollow channel communicating with an interior of the inner drum 5 is formed in the inner drum shaft, and a water inlet pipeline of the washing machine communicates with the hollow channel of the inner drum shaft.

[0054] In this embodiment, the inner drum 5 is provided with a pressure balancing mechanism used for communicating the inner drum 5 with the external environment so as to balance the pressure in the inner drum.

[0055] During water inlet, air in the sealed compartment of the inner drum is pressed and can overflow through the pressure balancing mechanism to ensure pressure balance.

[0056] When water is suddenly cut off, external atmosphere can quickly enter the sealed compartment of the inner drum and destroy suck-back, pressure balance is guaranteed, and washing water is prevented from being sucked into a tap water pipe network.

[0057] In other cases, such as dewatering, the pressure balancing mechanism can also ensure the pressure balance of the inner drum.

[0058] As one implementation of this embodiment, the pressure balancing mechanism includes a pressure equalizing hole channel formed in the inner drum 5, and one end, communicating with the interior of the inner drum 5, of the pressure equalizing hole channel is arranged at a position, close to a rotating central shaft, of the inner drum 5 and is always higher than the highest water level position in the inner drum 5.

[0059] Specifically, the pressure equalizing hole channel is formed in the inner drum shaft and communicates the interior of the inner drum 5 with the external environment, and the highest water level in the inner drum 5 is lower than the inner drum shaft. Thus, water in the inner drum 5 can be prevented from flowing out of the pressure equalizing hole channel.

[0060] The pressure equalizing hole channel in this embodiment includes a first hole channel section and a second hole channel section, the first hole channel section is parallel to the hollow channel, one end of the first hole channel section communicates with the interior of the inner drum, one end of the second hole channel section communicates with the first hole channel section, and the other end of the second hole channel section extends to a peripheral wall of the inner drum shaft to communicate with the interior of the outer drum. Preferably, the second hole channel section is perpendicular to the first hole channel section to form an L-shaped pressure equalizing hole channel.

[0061] This embodiment provides a front-opening drum washing machine with an inner drum, wherein the inner drum door 14 is arranged on the inner drum 5, washing in a closed space of the inner drum 5 is achieved, the possibilities that the clothes in the inner drum 5 come out, water flows out or is splashed out from the inner drum due to compression and beating of the clothes, and the dirt is attached between the inner drum and the outer drum are avoided, and no water exists between the inner and outer drums.

[0062] In this embodiment, the washing machine is provided with a door lock detection device for detecting whether an inner drum door lock is locked in place, which ensures that the inner drum door is locked in place, and ensures 100% of locking judgment accuracy. Due to the fact that the dewatering rotating speed of a drum can reach 1600 revolutions per minute, if the inner drum door on the inner drum is not locked well, safety accidents will happen. The safety of the washing machine, the user health and the user experience are greatly improved.

[0063] In order to achieve drainage of the non-porous inner drum, in this embodiment, drainage holes are formed in the side wall of the inner drum, a centrifugal drainage mechanism is mounted in each drainage hole, the centrifugal drainage mechanisms maintain the drainage holes normally closed to form a non-porous inner drum that holds washing water independently, the inner drum is controlled to rotate at a high speed when drainage is desired, the centrifugal drainage mechanisms enable the drainage holes to be opened under the centrifugal action of high-speed rotation, and washing water is discharged from the drainage holes. Preferably, the centrifugal drainage mechanisms are disposed within internal chambers of the lifting ribs 6.

[0064] In this embodiment, the front panel of the housing is provided with a clothes adding opening and a door 2 mounted at the clothes adding opening to control opening and closing of the clothes adding opening.

[0065] In this embodiment, a main controller 3 of the washing machine is arranged at the upper part of the front panel of the housing, and a detergent dosing box 16 for dosing a detergent is arranged at the upper part of the outer drum 4 in the housing 1.

[0066] In this embodiment, the bottom of the outer drum 4 is connected to a drainage device 13 which is connected to a drain pipe 11 for directing water out of the housing 1.

[0067] This embodiment simultaneously provides a control method for a washing machine. During the process of heating water inside the inner drum of the washing machine, the temperature of the water inside the inner drum is determined by calculating the current of the electromagnetic heating driver 7 through detection analysis for feedback.

[0068] According to the washing machine in this embodiment, washing water is heated by electromagnetic heating, and by using an integrated resonant circuit, the

washing water heating temperature is measured.

[0069] During electromagnetic heating, the temperature of the electromagnetic heating coil 8 has little change, but the temperature of the wall of the inner drum is consistent with the water temperature, which causes the temperature of the wall of the inner drum to rise and the resistance to increase. Its resistance is a variable RT.

[0070] The eddy current in the metal inner drum also affects the electromagnetic heating coil 8 to form an oscillating circuit together, the electromagnetic heating coil 8 itself has a resistance R, and the eddy current of the metal inner drum also forms a varying resistance Rx to the electromagnetic heating coil 8. Further, the current of the electromagnetic heating driver is affected, and the current of the electromagnetic heating driver is analyzed and calculated for feedback to determine the temperature of water inside the inner drum.

[0071] Thus, the washing machine in this embodiment utilizes a principle of electromagnetic heating to determine the temperature of water inside the inner drum 5 by means of the mutual electromagnetic induction change between the electromagnetic heating coil 8 and the wall of the metal inner drum, thereby reducing arrangement of a temperature sensor, simplifying the structure of the washing machine and reducing the cost of the washing machine.

[0072] Further, set current intervals N1, N2,..., Nn of the electromagnetic heating driver corresponding to set water temperatures T1, T2,..., Tn are stored within the main controller of the washing machine, and the temperature of the water inside the inner drum of the washing machine is Tn when a current I, calculated through detection analysis, of the electromagnetic heating driver is within the set current interval Nn during the process of heating the water inside the inner drum of the washing machine.

[0073] According to the washing machine in this embodiment, the inner drum is controlled to rotate during the process of heating water inside the inner drum of the washing machine. The temperature of the whole surface of the inner drum is uniform by means of temperature equalization by continuously rotating the inner drum to achieve heat exchange between the water inside the inner drum and the inner drum, and then the water inside the inner drum is uniformly heated.

[0074] In order to achieve the temperature measurement of water inside the inner drum, as one implementation of this embodiment, the inner drum is controlled to rotate during the process of heating water inside the inner drum of the washing machine, and the temperature of the water inside the inner drum is determined every other set time t0 by calculating the current of the electromagnetic heating driver through detection analysis for feedback. In this way, the temperature measurement is realized synchronously without affecting the heating process, which is simple and convenient.

[0075] In order to achieve the temperature measurement of water inside the inner drum, as one implementation of this embodiment, the inner drum is controlled to rotate during the process of heating the water inside the inner drum of the washing machine, the inner drum is controlled to stop rotating every other set time t0, the positioning posts of the positioning device are controlled to extend out and to be matched with the positioning holes to lock the inner drum, and the temperature of the water inside the inner drum is determined by calculating the current of the electromagnetic heating driver through detection analysis for feedback. In this way, after the inner drum is locked by the positioning device, the temperature measurement is carried out to avoid current fluctuation and the measurement result is more accurate.

[0076] As one implementation of this embodiment, the washing machine controls and adjusts a heating power of the electromagnetic heating coil according to the process of heating the water inside the inner drum.

[0077] In this embodiment, the heating power is adjustable to meet different operating conditions:

variable power electromagnetic heating is performed according the load, the set temperature, water level and other parameters: for example, high power heating can be carried out under high water level and multi-load; while low power heating can be carried out under low water level and small load.

[0078] For another example, in the early stage, when the electromagnetic heating power is high for operation, and the set temperature is almost reached, low power heating is performed to achieve accurate temperature heating.

[0079] For another example, a user sets a high temperature of 90°C for boiling and washing at high temperature, and high-power heating can be used to shorten the time; and the user sets 30°C for heating washing at low temperature, and low-power electromagnetic heating may be employed.

[0080] According to the washing machine in this embodiment, there are many methods for adjusting the electromagnetic heating power, specifically including:

the frequency of excitation pulses is increased by the electromagnetic heating driver of the washing machine, and the heating power of the electromagnetic heating coil can be reduced when an operating circuit is in an imbalance state;

or, the washing machine applies excitation pulses through the electromagnetic heating driver at intervals so that the electromagnetic heating coil intermittently heats the inner drum, and an interval at which the inner drum is intermittently heated is controlled to adjust the electromagnetic heating power of the washing machine;

or, the electromagnetic heating driver is a controllable rectifier module, and the heating power of the electromagnetic heating coil is changed by controlling a voltage to change a DC output voltage rectified by the controllable rectifier module.

Embodiment 3

[0081] As shown in Figs. 1 and 3, this embodiment provides a washing machine, including:
an outer drum 4; an inner drum 5 disposed within the outer drum 4; an electromagnetic heating coil 8 disposed on the outer drum 4; and an electromagnetic induction coil 18 disposed on the inner drum 5, and located at a position opposite to the electromagnetic heating coil 8.

[0082] According to the washing machine in this embodiment, a metal drum wall of the inner drum 5 is heated through electromagnetic heating by the electromagnetic heating coil 8, and the inner drum 5 heats washing water inside the drum, achieving the heating washing function of the washing machine. According to the washing machine in this embodiment, for a heating method using the electromagnetic heating coil 8, the electromagnetic induction coil 18 is disposed on the inner drum, an alternating magnetic field generated by the electromagnetic induction coil 18 during heating reacts on the electromagnetic heating coil 8, because the electromagnetic induction coil 18 is disposed within the inner drum 5, the temperature rises with the increase of water temperature, an eddy current within the electromagnetic induction coil 18 of which the temperature rises changes, and the alternating magnetic field that reacts on the electromagnetic heating coil 8 changes. The electromagnetic induction coil 18 affects the electromagnetic heating coil 8 to form an oscillation circuit together, the electromagnetic heating coil 8 itself has a resistance R, and the electromagnetic induction coil 18 forms a varying resistance R2 to the electromagnetic heating coil 8; and further, the current of the electromagnetic heating driver of the electromagnetic heating coil 8 is affected, and the current of the electromagnetic heating driver is analyzed and calculated for feedback to determine the temperature of water inside the inner drum 5.

[0083] Thus, the washing machine in this embodiment utilizes a principle of electromagnetic heating to determine the temperature of water inside the inner drum 5 by means of the mutual electromagnetic induction change between the electromagnetic heating coil 8 and the electromagnetic induction coil 18, thereby reducing arrangement of a temperature sensor, simplifying the structure of the washing machine and reducing the cost of the washing machine.

[0084] Preferably, the washing machine in this embodiment is a drum washing machine provided with a non-porous inner drum of a front-opening structure, and is simple in structure, and the washing water consumption of the washing machine can be greatly reduced without filling washing/rinsing water between the inner drum and the outer drum. The possibility of dirt adhesion between the inner drum and the outer drum is avoided. The user health and the user experience are greatly improved, and water resources are greatly saved.

[0085] The washing machine in this embodiment employs the non-porous inner drum, the inner drum independently holds washing water during washing, heating of washing water for the washing machine provided with the non-porous inner drum cannot achieved by a resistance wire heating mode of a conventional washing machine, and since the inner drum needs to rotate during the washing process, it is also not possible to provide a heating device within the inner drum to heat water inside the inner drum, so for the washing machine provided with the non-porous inner drum in this embodiment, a side wall of the inner drum 5 is heated by the electromagnetic heating coil 8, and then the heat is transferred to washing water inside the inner drum 5, thereby realizing heating of the washing water.

[0086] In addition, because of a resistance wire heating mode adopted by the existing washing machine, a resistance wire is immersed in water for direct heating, due to the fact that the water environment is complex, scales deposit on the resistance wire along with the increase of time, and the resistance wire is not easy to clean due to the mounting position, so that the heating efficiency is gradually reduced, and even damage is caused. In this embodiment, an electromagnetic heating device is adopted to achieve non-contact heating, so that the above problem can be solved, the service life is greatly prolonged, and long-term high-efficiency heating can be kept.

[0087] In order to achieve electromagnetic heating, the inner drum in this embodiment is made of a ferrous material and can cut alternating magnetic lines generated by the electromagnetic heating coil 8 to generate an alternating current (i.e. an eddy current), the eddy current enables carriers on the side wall of the inner drum to move irregularly at a high speed, and the carriers collide and rub against each other to generate thermal energy to heat the water inside the inner drum.

[0088] Further, in this embodiment, the electromagnetic heating coil 8 is disposed on a bottom of a peripheral side wall of the outer drum 4, and the electromagnetic induction coil 18 is disposed on an inner face of a peripheral side wall of the inner drum 5; and the electromagnetic induction coil 18 and the electromagnetic heating coil 8 are in the same radial direction of the outer drum 4 during rotation of the inner drum. In this way, during the heating process, the inner drum 5 needs to be controlled to rotate to a position where the electromagnetic induction coil 18 is opposite to the electromagnetic heating coil 8 to achieve temperature measurement.

[0089] In order to make the electromagnetic induction coil 18 to be positioned at a position opposite to the electromagnetic heating coil 8 to realize temperature measurement, in this embodiment, the outer drum 4 is provided with a positioning device, the positioning device is provided with retractable positioning posts, the inner drum 5 is provided with positioning holes for matching with the positioning posts; and the electromagnetic induction coil 18 is opposite to the electromagnetic heating coil 8 when the positioning posts of the positioning device extend out and are matched with the positioning holes to lock the

inner drum.

[0090] As one implementation of this embodiment, the electromagnetic induction coil 18 in this embodiment is encapsulated by an encapsulating structure 10 made of an insulating material, and the encapsulating structure 10 has a connecting structure for connecting with the inner drum. Further, the electromagnetic heating coil 8 is disposed on the inner face of the peripheral side wall of the outer drum 4, the electromagnetic heating coil 8 is encapsulated by an encapsulating structure 10 of an insulating material, and the encapsulating structure 10 has a connection structure for connection with the outer drum.

[0091] In this embodiment, the electromagnetic heating coil 8 and the electromagnetic induction coil 18 are high-frequency resonance coils that are wound by a copper wire in concentric circles. The electromagnetic induction coil 18 and the electromagnetic heating coil 8 are encapsulated by the encapsulating structure 10 to avoid the contact of water with the electromagnetic induction coil 18, thus improving the reliability and safety.

[0092] The washing machine in this embodiment further includes an electromagnetic heating driver 7 electrically connected to the electromagnetic heating coil 8, wherein the electromagnetic heating driver 7 rectifies an alternating current into a direct current, and then converts the direct current into a high-frequency alternating current; and the electromagnetic heating driver 7 outputs the high-frequency alternating current to the electromagnetic heating coil 8, thereby generating a high-frequency alternating magnetic field in which the inner drum is heated due to an induction eddy current generated by electromagnetic induction, heating water inside the inner drum 5.

[0093] As one implementation of this embodiment, the back of the electromagnetic heating coil 8 and the back of the electromagnetic induction coil 18 in this embodiment are provided with a plurality of magnetic strips 12 to absorb magnetic induction lines and reduce leakage of the magnetic induction lines.

[0094] As one implementation of this embodiment, the washing machine in this embodiment further includes a resonant circuit electrically connected to the electromagnetic heating driver 7, and a temperature detection circuit coupled to the resonant circuit. In this embodiment, the current of the electromagnetic heating driver 7 is detected for feedback to determine the temperature of the water inside the inner drum 5 through the temperature detection circuit.

[0095] This embodiment simultaneously provides a control method for a washing machine, wherein the washing machine includes an electromagnetic heating coil 8 and an electromagnetic heating driver 7 electrically connected to the electromagnetic heating coil 8, and the control method includes:

controlling the inner drum to be in a position where the electromagnetic induction coil is opposite to the electromagnetic heating coil during the process of heating water inside the inner drum of the washing machine, and determining the temperature of the water inside the inner drum by calculating a current of the electromagnetic heating driver through detection analysis for feedback.

[0096] A heating/drying program of the washing machine in this embodiment is operated, the current and voltage are converted into a direct current through the electromagnetic heating driver 7, so that the direct current is converted into a high-frequency alternating current that exceeds the audio frequency, and the high-frequency alternating current with a frequency of 0-100 KHz is output onto the electromagnetic heating coil 8, thereby generating a high-frequency alternating magnetic field; its electromagnetic induction lines act on the inner drum made of a metal material, a strong eddy current is generated in the metal inner drum due to electromagnetic induction, the conversion from electric energy to heat energy is completed when the eddy current flows against the internal resistance of the inner drum, realizing the heating of the inner drum, and heating of the water inside the inner drum.

[0097] According to the washing machine in this embodiment, washing water is heated by electromagnetic heating, and by using an integrated resonant circuit, the washing water heating temperature is measured.

[0098] According to the washing machine in this embodiment, the inner drum 5 may be positioned and locked by the positioning device during heating, so that the electromagnetic induction coil 18 fixed on the inner surface of the inner drum 5 is opposite to the electromagnetic heating coil 8 fixed on the outer drum.

[0099] During electromagnetic heating, the temperature of the electromagnetic heating coil 8 has little change, but the temperature of the electromagnetic induction coil 18 on the inner surface of the inner drum is consistent with the water temperature, which causes the temperature of the electromagnetic induction coil 18 to rise and the resistance to increase. Its resistance is a variable R1.

[0100] The electromagnetic induction coil 18 in turn affects the electromagnetic heating coil 8 to form an oscillation circuit together, the electromagnetic heating coil 8 itself has a resistance R, and the electromagnetic induction coil 18 forms a varying resistance R2 to the electromagnetic heating coil 8. Further, the current of the electromagnetic heating driver 7 is affected. The current of the electromagnetic heating driver 7 is analyzed and calculated for feedback to determine the temperature of water inside the inner drum.

[0101] Further, set current intervals N1, N2,..., Nn of the electromagnetic heating driver corresponding to set water temperatures T1, T2,..., Tn are stored within a main controller of the washing machine, and the temperature of the water inside the inner drum of the washing machine is Tn when a current I, calculated through detection analysis, of the electromagnetic heating driver is within the set current interval Nn during the process of heating the water inside the inner drum of the washing machine.

[0102] According to the washing machine in this em-

bodiment, the inner drum is controlled to rotate during the process of heating water inside the inner drum of the washing machine. The temperature of the whole surface of the inner drum is uniform by means of temperature equalization by continuously rotating the inner drum to achieve heat exchange between the water inside the inner drum and the inner drum, and then the water inside the inner drum is uniformly heated.

[0103] Thus, in order to achieve temperature measurement during the heating process, for the washing machine in this embodiment, the inner drum is controlled to stop rotating every other set time t0, the electromagnetic induction coil is controlled to be opposite to the electromagnetic heating coil when the positioning posts of the positioning device extend out and are matched with the positioning holes to lock the inner drum, and the temperature of the water inside the inner drum is determined by calculating the current of the electromagnetic heating driver through detection analysis for feedback.

[0104] As one implementation of this embodiment, the washing machine controls and adjusts a heating power of the electromagnetic heating coil according to the process of heating the water inside the inner drum.

[0105] In this embodiment, the heating power is adjustable to meet different operating conditions:
variable power electromagnetic heating is performed according the load, the set temperature, water level and other parameters: for example, high power heating can be carried out under high water level and multi-load; while low power heating can be carried out under low water level and small load.

[0106] For another example, in the early stage, when the electromagnetic heating power is high for operation, and the set temperature is almost reached, low power heating is performed to achieve accurate temperature heating.

[0107] For another example, a user sets a high temperature of 90°C for boiling and washing at high temperature, and high-power heating can be used to shorten the time; and the user sets 30°C for heating washing at low temperature, and low-power electromagnetic heating may be employed.

[0108] The above description is only preferred embodiments of the present disclosure, and is not intended to limit the present disclosure in any way. Although the present disclosure has been disclosed in the preferred embodiments, it is not intended to limit the present disclosure. Any technician familiar with this patent can make some changes or modifications to equivalent embodiments with equivalent changes by using the above-mentioned suggestive technical contents without departing from the scope of the technical solution of the present disclosure. However, any simple amendments, equivalent changes and modifications made to the above embodiments according to the technical essence of the present disclosure without departing from the contents of the technical solution of the present disclosure are still within the scope of the solution of the present disclosure.

Claims

1. A control method for a washing machine, the washing machine comprises a housing; an inner drum is disposed within the housing and is provided with a washing cavity for independently holding washing water; and an electromagnetic heating device is disposed within the housing and used for correspondingly heating a side wall of the inner drum; **characterized in that**, the control method comprises:
controlling the electromagnetic heating device to start heating the inner drum when the washing machine performs a last rinsing program and/or a dewatering program.

2. The control method for the washing machine according to claim 1, **characterized in that**, the dewatering program of the washing machine comprises an accelerated dewatering phase in which a rotating speed of the inner drum gradually increases and a stable dewatering phase in which the rotating speed of the inner drum remains unchanged, and the washing machine controls the electromagnetic heating device to start heating the inner drum at least during the accelerated dewatering phase.

3. The control method for the washing machine according to claim 2, **characterized in that**, the washing machine controls the electromagnetic heating device to remain operated throughout the accelerated dewatering phase and to be turned off when entering the stable dewatering phase.

4. The control method for the washing machine according to claim 2, **characterized in that**, the washing machine controls the electromagnetic heating device to be operated at intervals at a set time interval during the stable dewatering phase.

5. The control method for the washing machine according to claim 4, **characterized in that**, the stable dewatering phase comprises a low-speed stable dewatering phase and a high-speed stable dewatering phase, and the washing machine controls the electromagnetic heating device to be operated at intervals at a first set time interval T1 during the low-speed stable dewatering phase and to be operated at intervals at a second set time interval T2 during the high-speed stable dewatering phase, the second set time interval T2 is greater than or equal to the first set time interval T 1.

6. The control method for the washing machine according to any one of claims 2 to 5, **characterized in that**, an electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls the heating power of the electromagnetic heating device during the acceler-

ated dewatering phase to be greater than a heating power during the stable dewatering phase; and preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a first heating power P1 during the low-speed stable dewatering phase, heat the inner drum at a second heating power P2 during the accelerated dewatering phase, and heat the inner drum at a third heating power P3 during the high-speed stable dewatering, the second heating power P2 is greater than the first heating power P1 which is greater than or equal to the third heating power P3.

7. The control method for the washing machine according to claim 1, **characterized in that**, the last rinsing program of the washing machine comprises a rinsing water inlet phase, a rinsing washing phase, and a rinsing drainage phase, and the washing machine controls the electromagnetic heating device to be operated at least during the rinsing drainage phase.

8. The control method for the washing machine according to claim 7, **characterized in that**, drainage holes are formed in the side wall of the inner drum, and centrifugal drainage mechanisms for controlling opening and closing of the drainage holes are mounted in the drainage holes, the centrifugal drainage mechanisms maintain the drainage holes in a normally closed condition, and the centrifugal drainage mechanisms enable the drainage holes to be opened by a centrifugal force from a rotation of the inner drum when a rotating speed of the inner drum reaches V0; and
when the washing machine performs the last rinsing program, the inner drum is controlled to rotate at a rotating speed of V0, the washing machine enters the rinsing drainage phase, the electromagnetic heating device is controlled to be operated, and the electromagnetic heating device is controlled to be turned off when the inner drum continuously rotates at the rotating speed of V0 for a set time of T0.

9. The control method for the washing machine according to claim 8, **characterized in that**, an electromagnetic heating power of the electromagnetic heating device is adjustable, and the washing machine controls the heating power of the electromagnetic heating device during the rinsing drainage phase to be greater than heating powers during other rinsing phases; and
preferably, the washing machine controls the electromagnetic heating device to heat the inner drum at a fourth heating power P4 in the rinsing water inlet phase, and heat the inner drum at a fifth heating power P5 in the rinsing drainage phase, the fourth heating power P4 is smaller than or equal to the fifth heating power P5.

10. The control method for the washing machine according to any one of claims 1 to 9, **characterized in that**, the electromagnetic heating power of the electromagnetic heating device is adjustable, and a main controller of the washing machine stores a correspondence between a clothes load interval of the washing machine and the electromagnetic heating power:
when the washing machine detects that a clothes load is in a corresponding clothes load interval, the washing machine controls the electromagnetic heating device for heating with an electromagnetic heating power corresponding to this load interval.

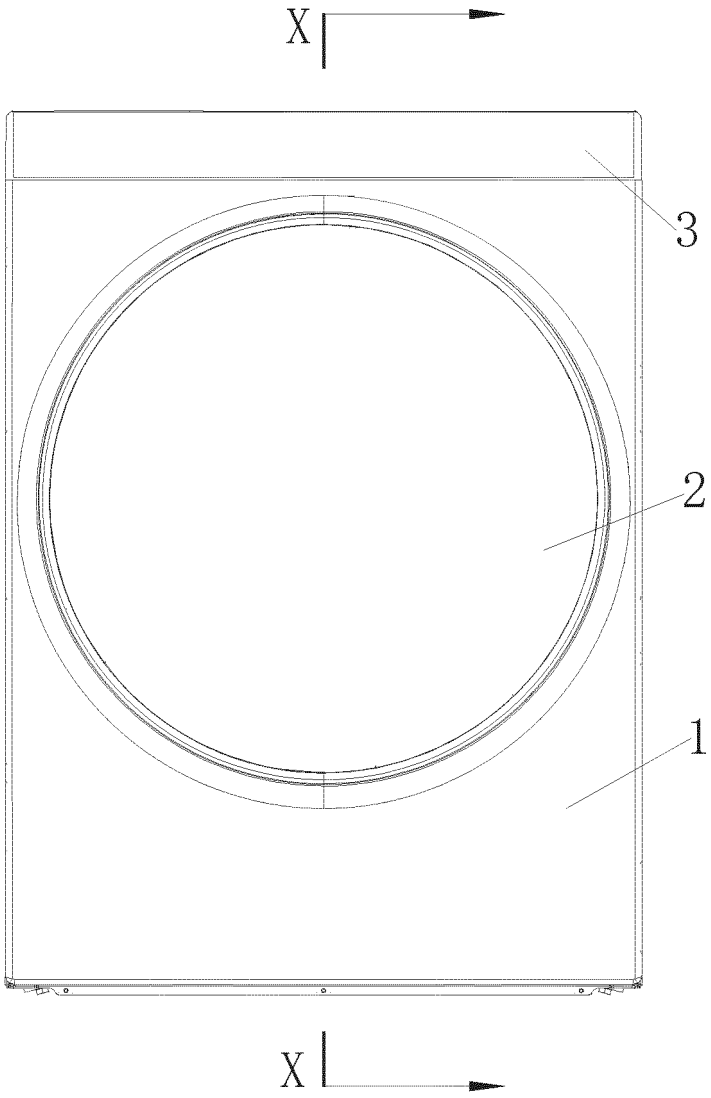

Fig. 1

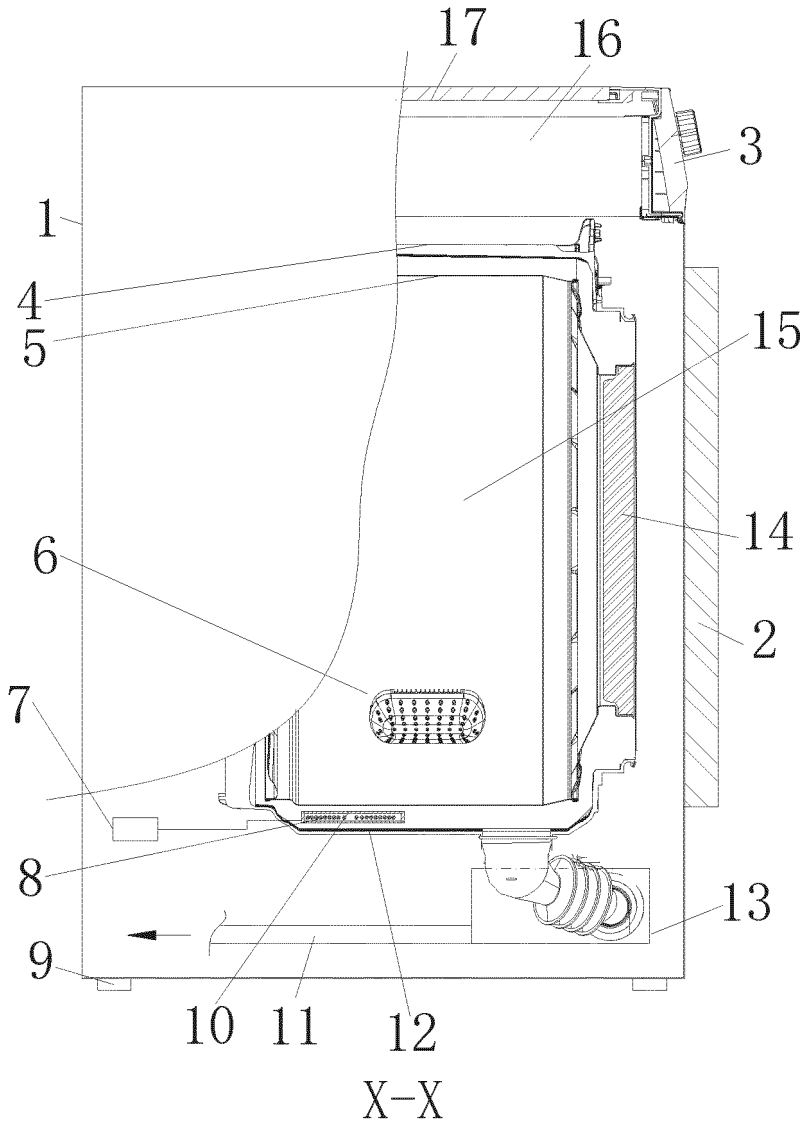

Fig. 2

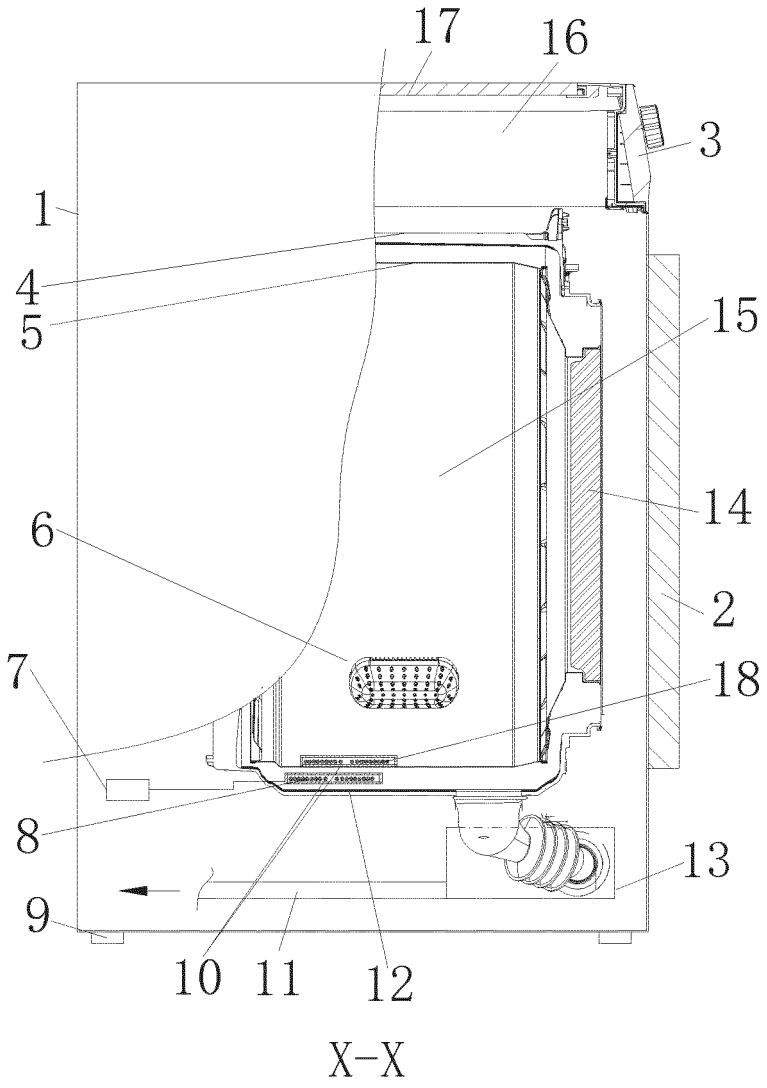

Fig. 3

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2021/113471

A. CLASSIFICATION OF SUBJECT MATTER

D06F 39/04(2006.01)i; D06F 105/28(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)

CNABS, CNTXT, DWPI, SIPOABS, CNKI: 电磁, 感应, 涡流, 加热, 外筒, 外桶, 盛水桶, 盛水筒, 水槽, 漂洗, 甩干, 脱水, electromagnet+, induct+, eddy, current, heat+, tub, basket, rins+, spin+, dehydra+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	CN 111041761 A (QINGDAO HAIER WASHING MACHINE CO., LTD. et al.) 21 April 2020 (2020-04-21) description, paragraphs [0142]-[0148], and figures 24-25	1, 2, 7, 8, 10
Y	CN 111394928 A (LG ELECTRONICS INC.) 10 July 2020 (2020-07-10) description paragraphs [0123]-[0136]	1, 2, 7, 8, 10
A	CN 211395082 U (PANASONIC HOME APPLIANCES R&D CENTER (HANGZHOU) CO., LTD.) 01 September 2020 (2020-09-01) entire document	1-10
A	CN 209555576 U (CHANGCHUN ZHONGJI ALTERNATING FREQUENCY TECHNOLOGY CO., LTD.) 29 October 2019 (2019-10-29) entire document	1-10
A	EP 3287558 A1 (LG ELECTRONICS INC.) 28 February 2018 (2018-02-28) entire document	1-10

☐ 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
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"P" document published prior to the international filing date but later than the priority date claimed
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"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
05 November 2021	**26 November 2021**
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
Information on patent family members

International application No.
PCT/CN2021/113471

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		KR 20200079934 A	06 July 2020
		WO 2020138901 A1	02 July 2020
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CN 209555576 U	29 October 2019	None	
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Form PCT/ISA/210 (patent family annex) (January 2015)

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