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(54) FRONT-LOADING WASHING MACHINE

(57) A drum washing machine includes: an inner drum (17) with an inner drum opening; an inner drum door (6) mounted at the inner drum opening in an opened/closed manner; a position detection device, configured to detect whether the inner drum door (6) is locked; and a door closing hindering device (55), configured to apply force for hindering closing of the inner drum door (6). By means of the arranged door closing hindering device (55), force for hindering closing of the inner drum door (6) is generated when the inner drum door (6) is closed. When the inner drum door (6) is not locked, the inner drum door (6) is opened by a certain angle. The phenomenon that the position detection device misjudges that the inner drum door (6) is locked well due to the fact that the inner drum door (6) is not locked but still closed at a drum opening or the opening angle is very small is avoided.

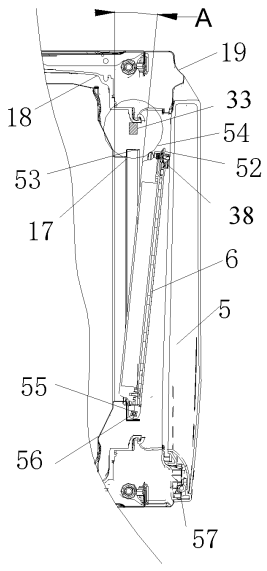

Fig.23

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Description

TECHNICAL FIELD

[0001] The invention belongs to the technical field of washing machine, and particularly relates to a drum washing machine.

BACKGROUND

[0002] As a most widely used household appliance in daily life of people, the washing machine helps people get rid of the trouble of washing laundry and brings great convenience to people. However, the washing machine has certain defects such as taking long time and using large water. Along with social development, the water resource is becoming more and more important as an important natural resource, and the water saving awareness of people is improved. In order to improve the water saving function of the washing machine, an inner drum structure without holes is adopted. However, the biggest problem of the inner drum structure without holes is in a problem to close in seal an inner drum door. Due to negligence of a user, the inner drum door is not locked in place, but a position detection device does not detect the above situation to cause water leakage under the conditions of washing or rinsing and dewatering, and a door body is not locked in place and rotation at a high speed to cause damage and the like occur.

[0003] According to an inner drum washing machine without holes in the prior arts, the situation that an inner drum door is unlocked but still closed on an inner drum opening or the opening angle is very small easily occurs, so that the inner drum door is actually unlocked. Whereas the position detection device for detecting whether the inner drum door is locked or not misjudges that the inner drum door is locked. After the washing machine is started, the inner drum rotates at a high speed, and safety accidents are likely to happen. Therefore, those skilled in the field urgently need to develop a washing machine which can more accurately judge whether the inner drum door is locked or not.

[0004] In view of this, the invention is proposed.

SUMMARY

[0005] The technical problem to be solved by the invention is to overcome the defects in the prior art, and the invention provides a drum washing machine capable of accurately judging whether the inner drum door is locked or not.

[0006] In order to achieve the objective, the following technical solution is adopted.

[0007] A drum washing machine includes: an inner drum with an inner drum opening; an inner drum door, mounted at the inner drum opening in an opened and closed manner; a position detection device, configured to detect whether the inner drum door is locked or not; and a door closing hindering device, configured to apply force on the inner drum door for hindering being closed.

[0008] In one embodiment, the door closing hindering device is arranged on the inner drum; or the door closing hindering device is arranged on the inner drum door; or, the door closing hindering device is arranged between the inner drum and the inner drum door.

[0009] In one embodiment, the door closing hindering device is an elastic piece arranged between the inner drum and the inner drum door, and two elastic ends of the elastic piece abut against the inner drum and the inner drum door.

[0010] In one embodiment, the inner drum door is connected to the inner drum opening through an inner drum door shaft. The elastic piece is a torsional spring arranged on the inner drum door shaft in a sleeving mode. The torsional spring includes a torsional spring body in a spiral shape, the torsional spring body is arranged on the inner drum door shaft in a sleeving mode, and two end parts of the torsion spring body extend outwards and respectively abut against the inner drum and the inner drum door.

[0011] In one embodiment, the door closing hindering device is a hydraulic telescopic rod, an gas pressure telescopic rod or a compression spring.

[0012] In one embodiment, the position detection device includes: a detected terminal arranged on the inner drum door; and a position sensor arranged correspondingly to the detected terminal and provided with a sensing area capable of sensing the detected terminal.

[0013] In one embodiment, the drum washing machine further includes an outer drum which is arranged outside the inner drum in a sleeving mode and is coaxial with the inner drum, and the position sensor is arranged on the outer drum and corresponds to the position of the detected terminal.

[0014] In one embodiment, the drum washing machine further includes a shell arranged outside the inner drum, and the position sensor is arranged on the shell and corresponds to the position of the detected terminal.

[0015] In one embodiment, the inner drum door is locked on the inner drum through a locking mechanism. The locking mechanism includes a locking piece arranged on the inner drum door and a locking groove arranged in the inner drum corresponding to the locking piece. The detected terminal is arranged on the locking piece.

[0016] In one embodiment, the position detection device is an electromagnetic type sensor, the position sensor is an electromagnetic sensor, and the detected terminal is a permanent magnet rotor;

or the position detection device is a photoelectric type position sensor, the position sensor is a photoelectric sensor, and the detected terminal is a shading plate;

or the position detection device is a differential volt-

age type sensor, the position sensor is a differential voltage sensor, and the detected terminal is an armature;

or the position detection device is an eddy current type sensor, the position sensor is an eddy current sensor, and the detected terminal is a metal plate;

or the position detection device is a Hall type sensor, the position sensor is a Hall sensor, and the detected terminal is a permanent magnet;

or the position detection device is a reed switch type sensor, the position sensor is a reed switch sensor, and the detected terminal is a permanent magnet.

[0017] In one embodiment, the door closing hindering device includes a magnetic element which is able to attract and repel the inner drum door, and applies force on the inner drum door for hindering being closed.

[0018] In one embodiment, the magnetic element includes a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged at the inner drum opening, and the first magnetic element and the second magnetic element repel each other.

[0019] In other embodiment, same magnetic poles of the first magnetic element and the second magnetic element face with each other.

[0020] In other embodiment, both the first magnetic element and the second magnetic element are permanent magnets.

[0021] In one embodiment, the drum washing machine further includes a shell arranged outside the inner drum. The magnetic element includes a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged on the shell, and the first magnetic element and the second magnetic element attract each other.

[0022] In one embodiment, the drum washing machine further includes a shell arranged outside the inner drum, a machine door is arranged at the position, corresponding to the inner drum door, of the shell, and the magnetic element includes a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged on the machine door, and the first magnetic element and the second magnetic element attract each other.

[0023] In one embodiment, the first magnetic element is a magnetic induction piece or a permanent magnet arranged on the inner drum door, and the second magnetic element is an electromagnetic module arranged correspondingly.

[0024] In one embodiment, anisotropic magnetic poles of the first magnetic element and the second magnetic element face with each other.

[0025] In other embodiment, both the first magnetic element and the second magnetic element are permanent magnets.

[0026] In one embodiment, the first magnetic element is a magnetic induction piece, and the second magnetic element is a permanent magnet. Alternatively the first magnetic element is a permanent magnet, and the second magnetic element is a magnetic induction piece.

[0027] In one embodiment, the position detection device includes: a detected terminal arranged on the inner drum door; and a position sensor arranged correspondingly to the detected terminal and provided with a sensing area capable of sensing the detected terminal.

[0028] In one embodiment, the position sensor is a reed switch sensor.

[0029] In one embodiment, the drum washing machine further includes an outer drum which is arranged outside the inner drum in a sleeving mode and coaxial with the inner drum, and the position sensor is correspondingly arranged on the outer drum and corresponds to the position of the detected terminal.

[0030] Alternatively, the drum washing machine further includes a shell arranged outside the inner drum, and the position sensor is correspondingly arranged on the shell and corresponds to the position of the detected terminal.

[0031] In one embodiment, the inner drum door is locked on the inner drum through a locking mechanism. The locking mechanism includes a locking piece arranged on the inner drum door and a locking groove arranged in the inner drum corresponding to the locking piece, and the detected terminal is arranged on the locking piece.

[0032] After the above technical solution is adopted, compared with the prior art, the invention has the following beneficial effects.

[0033] According to the drum washing machine provided by the invention, through the arrangement of the door closing hindering device, when the inner drum door is closed, the force on the inner drum door for hindering being closed is generated. If the inner drum door is not locked, the inner drum door is opened by a certain angle, so that the detected terminal on the inner drum door is not in the sensing range of the position sensor, and the probability of misjudgment of the position detection device is reduced. The problems in the prior art is avoided, such as the inner drum door is unlocked, but the inner drum door is still closed at the inner drum opening or the opening angle is very small, so that the position detection device misjudges that the inner drum door is locked, thereby after the washing machine is started, the inner drum rotates at a high speed to cause safety accidents.

[0034] The specific implementation modes of the invention are further described in detail in combination with attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0035]

Fig. 1 shows a principle schematic diagram of the

drum washing machine in Embodiment I of the invention;

Fig. 2 shows a principle schematic diagram of the drum washing machine in Embodiment II of the invention (a first implementation mode);

Fig. 3 shows a principle schematic diagram of the drum washing machine in the Embodiment II of the invention (a second implementation mode);

Fig. 4 shows a principle schematic diagram of the drum washing machine in the Embodiment II of the invention (a third implementation mode);

Fig. 5 shows a principle schematic diagram of the drum washing machine in Embodiment III of the invention;

Fig. 6 shows a local magnification diagram in Fig. 5 of the drum washing machine in the Embodiment III of the invention (in a depressurization state);

Fig. 7 shows a local magnification diagram in Fig. 5 of the drum washing machine in the Embodiment III of the invention (in a pressurization state);

Fig. 8 shows a principle schematic diagram of the drum washing machine in Embodiment IV of the invention;

Fig. 9 shows a local magnification diagram in Fig. 8 of the drum washing machine in the Embodiment IV of the invention (in a depressurization state of the first implementation mode);

Fig. 10 shows a local magnification diagram in Fig. 8 of the drum washing machine in the Embodiment IV of the invention (in a pressurization state of the first implementation mode);

Fig. 11 shows a local magnification diagram in Fig. 8 of the drum washing machine in the Embodiment IV of the invention (in a depressurization state of the second implementation mode);

Fig. 12 shows a local magnification diagram in Fig. 8 of the drum washing machine in the Embodiment IV of the invention (in a pressurization state of the second implementation mode);

Fig. 13 shows a principle schematic diagram of the drum washing machine in Embodiment V of the invention;

Fig. 14 shows a bottom view of the drum washing machine in the Embodiment V of the invention;

Fig. 15 shows a three-dimensional structure diagram of the drum washing machine in the Embodiment V of the invention;

Fig. 16 shows a local magnification diagram in Fig. 15 of the drum washing machine in the Embodiment V of the invention;

Fig. 17 shows a principle schematic diagram of the drum washing machine in Embodiment VI of the invention (the first implementation mode);

Fig. 18 shows a principle schematic diagram of the drum washing machine in the Embodiment VI of the invention (the second implementation mode);

Fig. 19 is a structural diagram of the drum washing machine in Embodiment VII of the invention;

Fig. 20 shows a local magnification diagram in Fig. 19 in the Embodiment VII of the invention;

Fig. 21 shows a principle schematic diagram of the drum washing machine in Embodiment VIII of the invention;

Fig. 22 shows a principle schematic diagram of the drum washing machine in Embodiment IX of the invention;

Fig. 23 shows another principle schematic diagram of the drum washing machine in the Embodiment IX of the invention;

Fig. 24 shows a principle schematic diagram of the drum washing machine in Embodiment X of the invention (the first implementation mode);

Fig. 25 shows a principle schematic diagram of the drum washing machine in the Embodiment X of the invention (the second implementation mode); and

Fig. 26 shows a principle schematic diagram of the drum washing machine in the Embodiment X of the invention (the third implementation mode).

[0036] In the drawings, 1. flow sensor; 2. upper deck plate; 3. detergent box; 4. master controller; 5. machine door; 6. inner drum door; 611. rotating part; 612. pushing part; 7. water outlet; 8. drainage pipeline; 9. bottom foot; 10. pushing rod mechanism; 11. one-way valve plug; 12. bearing; 13. shaft; 14. hollow channel; 15. first dynamic sealing structure; 16. driving motor; 17. inner drum; 18. outer drum; 19. shell; 20. water inlet valve; 21. water measuring tank; 22. water level detection device; 23. water tank draining pump; 24. overflow hole; 25. water tank drain valve; 26. heating device; 27. pressure equalizing hole channel; 28. pressurization hole channel; 29. neg-

ative pressure safety valve; 30. depressurization hole channel; 31. positive pressure safety valve; 32. mounting bracket; 33. position sensor; 34. fixing knot; 35. locking mechanism; 38. detected terminal; 39. locking groove; 40. locking rod; 41. locking motor; 42. outer drum rear wall; 43. lifting rib; 46. inner drum door pushing and closing device; 52. locking piece; 53. locking groove; 54. sensing area; 55. door closing hindering device; 56. inner drum door shaft; 57. machine door shaft; 61. first magnetic element; 62. second magnetic element.

DETAILED DESCRIPTION

[0037] To make the objectives, technical solutions, and advantages of embodiments of the present invention clearer, the technical solutions will be clearly and completely described below with reference to the accompanying drawings in the embodiments of the present invention. The following embodiments are used to describe the present invention but not to limit the scope of the present invention.

[0038] As shown in Fig. 1-Fig. 26, a drum washing machine which is provided with an inner drum without holes and is of a front-open structure is provided by the embodiment. The drum washing machine is simple in structure, and washing/rinsing water does not need to be between the inner drum and the outer drum, so that the washing water used in the washing machine is greatly reduced. 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.

[0039] The drum washing machine of the embodiment is provided with a shell 19. The shell 19 includes an upper deck plate 2, a front plate, a rear back plate and a bottom plate. Bottom feet 9 are fixedly installed on the bottom plate and used for supporting the whole washing machine. An outer drum 18 is arranged in the shell 19, and an inner drum 17 is coaxially arranged in the outer drum 18. The outer drum 18 is mainly used for collecting water drained out of the inner drum 17 and water drained out of the inner drum 17 in high-speed centrifugal dewatering process. The inner drum rotates, and preferably, lifting ribs 43 are arranged, so that the laundry are continuously lifted, dropped and beaten cleaned. The inner drum 17 is of a structure without holes. The outer drum 18 is provided with a central mounting hole for mounting and fixing a bearing 12. An inner drum shaft 13 fixedly connected with the inner drum 17 penetrates through the bearing 12 and is connected with a driving motor 16. An inner drum door 6 capable of being opened/closed is installed on a drum opening in the front portion of the inner drum 17, and therefore the inner drum 17 is of a sealed cabin structure.

[0040] A machine door 5 capable of being opened/closed is installed on the shell 19.

Embodiment I

[0041] The embodiment of the invention mainly solves the problem of how to accurately determine the water inflow of the drum washing machine with aN inner drum without holes, and the specific solution is as follows.

[0042] The drum washing machine includes an inner drum 17 and a water inlet pipeline communicating with the inner drum 17. The inner drum 17 is a drum without holes and contains washing water when laundry are washed. A flow sensor 1 used for detecting water inflow is arranged on the water inlet pipeline.

[0043] According to the embodiment, the flow sensor 1 is arranged on the water inlet pipeline to monitor the water inflow. When the set water inlet amount is reached, a water inlet valve 20 is closed, and water feeding is completed. According to the embodiment, the flow sensor is adopted to solve the water feeding problem of the drum washing machine having the inner drum without holes according to the set water level, the washing effect is ensured, the structure is simple, and control is convenient.

[0044] Further, the drum washing machine of the embodiment includes a water inlet valve 20 and a detergent box 3. The water inlet pipeline includes a first water inlet pipe and a second water inlet pipe, the outlet end of the water inlet valve 20 is communicated with the detergent box 3 through the first water inlet pipe, and the outlet end of the detergent box 3 is communicated with the inner drum 17 through the second water inlet pipe. The flow sensor 1 is arranged on the first water inlet pipe or the second water inlet pipe.

[0045] Preferably, the flow sensor 1 is arranged on the first water inlet pipe, so that the detergent in the detergent box can be prevented from entering the flow sensor 1.

[0046] The drum washing machine of the embodiment includes a master controller 4, and the flow sensor 1 is electrically connected with the master controller 4 through a circuit. The master controller 4 can collect the water inflow of the inner drum 17 in real time, and the water inlet valve 20 is closed when the set water inflow is reached.

[0047] As an implementation mode of the embodiment, the flow sensor 1 is a rotor flow sensor, or a turbine flow sensor, or an ultrasonic flow sensor, or an electromagnetic flow sensor, or a pore plate flow sensor.

[0048] According to the embodiment, the flow sensor 1 can be arranged at any position of the water inlet pipeline. Preferably, the flow sensor 1 is arranged behind the water inlet valve 20 to accurately meter the flow of water entering the sealed inner drum 17. The flow sensor 1 is connected with the master controller 4 through a circuit, and the master controller 4 can collect the water inflow of the inner drum 17 in real time, so that the water inlet valve 20 is closed when the set water inflow is reached.

[0049] In order to feed water into the inner drum without holes, the drum washing machine of the embodiment includes a driving motor 16 and an inner drum shaft 13,

and the driving motor 16 is in transmission connection with the inner drum 17 through the inner drum shaft 13 to drive the inner drum 17 to rotate. A hollow channel 14 communicating with the interior of the inner drum 17 is formed in the inner drum shaft 13, and the water inlet pipeline is communicated with the hollow channel of the inner drum shaft 13.

[0050] Specifically, the inner drum shaft 13 is connected with the driving motor 16. The driving motor 16 includes a stator and a rotor, and the rotor is fixedly connected with the inner drum shaft 13. A through hole is formed in the center of the rotor, and the water inlet pipeline penetrates through the through hole of the rotor to be communicated with the hollow channel 14 of the inner drum shaft 13.

[0051] Further, a first dynamic sealing structure 15 is arranged between the water inlet pipeline and the through hole of the rotor, and a second sealing structure is arranged between the through hole of the rotor and the hollow channel 14 of the inner drum shaft 13.

[0052] In order to achieve drainage of the inner drum without holes, the drum washing machine of the embodiment includes an outer drum 18. An inner drum drainage hole is formed in the side wall of the inner drum 17, a one-way valve plug 11 which is normally closed is installed in the inner drum drainage hole, and a pushing rod mechanism 10 used for ejecting the one-way valve plug 11 open for drainage is installed on the outer drum 18.

[0053] Preferably, the outer drum 18 is further provided with a locking mechanism used for stopping rotation of the inner drum 17.After the locking mechanism locks the inner drum, the pushing rod mechanism 10 ejects the one-way valve plug 11 open for drainage.

[0054] In order to achieve dewatering of the inner drum without holes, a plurality of dewatering holes are formed in the side wall of the inner drum 17, and centrifugal valves are installed on the dewatering holes. The centrifugal valves are opened under the action of dewatering centrifugal force to conduct dewatering and drainage.

[0055] The embodiment of the invention also provides a control method of the drum washing machine. The washing machine executes a washing/rinsing program. In the water feeding process, the flow sensor detects the water inflow value in real time, the washing machine calculates the water inflow according to the water inflow value and the water feeding time, and water feeding is stopped when the water inflow reaches the set water inflow of the washing machine.

[0056] The drum washing machine is provided with a plurality of water inflow values which can be selected by a user, and water is fed into the washing machine according to the water inflow value selected by the user.

[0057] The drum washing machine has a laundry weighing function, and water can be fed after determining the water inflow value according to the weight of laundry.

Embodiment II

[0058] As shown in Fig. 2-Fig. 4, the drum washing machine includes an inner drum 17 and a water inlet pipeline. The inner drum is an inner drum without holes and contains washing water when laundry are washed. The drum washing machine further includes a water measuring device used for measuring the water inflow, the water inlet pipeline is communicated with the water measuring device, and the water measuring device is communicated with the inner drum.

[0059] Through the arrangement of the water measuring device of the drum washing machine of the embodiment, water enters the water measuring device for quantitative measurement before entering the inner drum 1. The water measuring frequency of the water measuring device is determined according to the set water level, and therefore the problem that water enters the drum washing machine having the inner drum without holes according to the set water level is solved, the washing effect is good, the structure is simple, and it is convenient to be controlled.

[0060] Further, the water measuring device includes a water measuring tank 21, and the water measuring tank 21 is provided with a water inlet and a water outlet. The water inlet is communicated with a water inlet pipeline, and the water outlet is communicated with the inner drum 17. The water outlet is provided with a water outlet control device which is used for controlling the water outlet to be opened when the water amount in the water measuring tank 21 reaches a set value.

[0061] As an implementation mode of the embodiment, as shown in Fig. 2, the water measuring tank 21 is arranged at the bottom of the inner drum 17. The water measuring device includes a water level detection device 22 used for detecting the water level in the water measuring tank 21. The water outlet control device is a water tank drainage pump 23. When it is detected by the water level detection device 22 that the water level in the water measuring tank 21 reaches a set value, the water tank drainage pump 23 is started to pump water in the water measuring tank 21 into the inner drum 17.

[0062] As an implementation mode of the embodiment, as shown in Fig. 3, the water measuring tank 21 is arranged above the inner drum 17. The water measuring device includes a water level detection device 22 used for detecting the water level in the water measuring water tank. The water outlet control device is a water tank drain valve 25. The water tank drain valve 25 is opened to drain water in the water measuring tank 21 into the inner drum when it is detected by the water level detection device 22 that the water level in the water measuring tank 21 reaches a set value.

[0063] The water level detection device 22 of the embodiment is a liquid level sensor. The liquid level sensor includes an gas chamber and a sensor unit, and the gas chamber is communicated with the water measuring tank. Or, the water level detection device 22 includes a

plurality of water level detection probes which are arranged in the water measuring tank in the depth direction of the water measuring tank.

[0064] As one implementation mode of the embodiment, the water measuring tank 21 is arranged above the inner drum 17. The water outlet is formed in the bottom wall of the water measuring tank 21. The water outlet control device is a water tank one-way valve for keeping the water outlet normally closed. When the water amount in the water measuring tank reaches a certain value, the water tank one-way valve is opened under the water pressure gravity. After water in the water measuring tank 21 is discharged into the inner drum 17, the water tank one-way valve resets to keep the water outlet closed.

[0065] An overflow hole 24 is formed in the water measuring tank 21 of the embodiment, and the overflow hole 24 is connected with an overflow pipeline used for guiding out water overflowing out of the water measuring tank.

[0066] Preferably, the drum washing machine includes a drainage pipeline 8, and the overflow pipeline is communicated with the drainage pipeline 8.

[0067] As an implementation mode of the embodiment, as shown in Fig. 4, the water measuring device includes a heating device 26 arranged in the water measuring tank 21 and a water temperature detection device for detecting the water temperature in the water measuring tank.

[0068] The embodiment of the invention also provides a control method of the drum washing machine. The drum washing machine controls the washing water to enter the water measuring tank in executing a washing program or a rinsing program. When the water amount in the water measuring tank reaches a set value, the water feeding is stopped, the water in the water measuring tank is completely discharged into the inner drum. Then the drum washing machine is restarted to feed water into the water measuring tank, and the above process is circulated until the water level in the inner drum reaches a set value, and water feeding is ended.

[0069] Further, the drum washing machine controls the washing water to enter the water measuring tank. When the water amount in the water measuring tank reaches a set value, water feeding is stopped, the heating device is controlled to operate to heat the washing water. When it is detected by the water temperature detection device that the water temperature in the water measuring tank reaches the set value, the water in the water measuring tank is completely discharged into the inner drum.

Embodiment III

[0070] The embodiment of the invention mainly solves how to ensure unbalanced gas pressure of a sealed cabin of a drum washing machine having an inner drum without holes. Specifically, the washing water in the sealed cabin is backflowed to a pipe network due to the fact that water of an electromagnetic valve is suddenly cut off, particularly water of a tap water pipe network is cut off, and negative pressure is formed; or water is difficult to enter into the inner drum due to gas existing inside.

[0071] As shown in Fig. 5-Fig. 7, the drum washing machine of the embodiment includes an inner drum 17 which is without holes and used for containing washing water when laundry are washed. The drum washing machine further includes a gas pressure balance mechanism used for communicating the inner drum 17 with the external environment to balance the gas pressure in the inner drum.

[0072] When feeding water, gas in the sealed cabin of the inner drum is pressed and can overflow through the balance mechanism, and gas pressure balance is kept.

[0073] When feeding water is suddenly cut off, external atmosphere can quickly enter the sealed cabin of the inner drum and destroy suck-back, and gas pressure balance is kept. Therefore washing water is prevented from being sucked into a tap water pipe network.

[0074] Under other conditions, for example, during dewatering, the gas pressure balance mechanism can also keep the gas pressure balance of the inner drum.

[0075] As an implementation mode of the embodiment, the gas pressure balance mechanism includes a pressure equalizing hole channel 27 arranged on the inner drum 17. One end, communicating with the interior of the inner drum 17, of the pressure equalizing hole channel 27 is arranged at the position, close to a rotating center shaft, of the inner drum 17 and is higher than the highest water level position in the inner drum 17.

[0076] The drum washing machine of the embodiment includes a driving motor 16 and an inner drum shaft 13, and the driving motor 16 is in transmission connection with the inner drum 17 through the inner drum shaft 13 to drive the inner drum 17 to rotate. The pressure equalizing hole channel 27 is formed in the inner drum shaft 13 to communicating the interior of the inner drum 17 with the external environment, and the highest water level in the inner drum 17 is lower than the inner drum shaft 13. Therefore, water in the inner drum can be prevented from flowing out of the pressure equalizing hole channel.

[0077] The drum washing machine of the embodiment includes an outer drum 18, in which the inner drum 17 is arranged. Water discharged from the inner drum 17 is discharged through the outer drum 18. An inner drum door 6 for closing the inner drum is installed on a drum opening of the inner drum 17. A drum opening of the outer drum 18 is open. One end of the pressure equalizing hole channel 27 is communicated with the interior of the inner drum 17, and the other end of the pressure equalizing hole channel 27 is arranged in the outer drum 18 and communicated with the outer drum 18. In this way, extreme conditions are prevented, and water discharged from the pressure equalizing hole channel can be collected in the outer drum 18.

[0078] Further, an inner drum drainage hole is formed in the side wall of the inner drum 17, an one-way valve plug 11 being normally closed is installed on the inner drum drainage hole, and a pushing rod mechanism 10 used for ejecting the one-way valve plug 11 open for

drainage is installed on the outer drum 18.

[0079] Preferably, the outer drum 18 is further provided with a locking mechanism used for locking rotation of the inner drum. After the locking mechanism locks the inner drum, the pushing rod mechanism ejects the one-way valve plug open for drainage.

[0080] Further, the drum washing machine of the embodiment includes a water inlet pipeline, a hollow channel 14 communicating with the interior of the inner drum 17 is arranged in the inner drum shaft 13, and the water inlet pipeline is communicated with the hollow channel 14 of the inner drum shaft 13. The pressure equalizing hole channel 27 and the hollow channel 14 are respectively communicated with the interior of the inner drum 17 and are arranged in interval. Therefore, gas in the sealed cabin of the inner drum can be smoothly discharged to keep gas pressure balance in the inner drum, and water leakage caused by the fact that inflow water is directly discharged from the pressure equalizing hole channel 27 is prevented.

[0081] Specifically, the hollow channel 14 extends from one end to the other end in the central axis direction of the inner drum shaft. The pressure equalizing hole channel includes a first hole channel section and a second hole channel section. The first hole channel section is parallel to the hollow channel, and one end of the first hole channel section is communicated with the interior of the inner drum. One end of the second hole channel section is communicated with the first hole channel section, and the other end passes through the outer peripheral wall of the inner drum shaft and is communicated with the interior of the outer drum.

[0082] Preferably, the second hole channel section is perpendicular to the first hole channel section to form an pressure equalizing hole channel with L-shape.

[0083] Further, the inner drum shaft 13 is connected with a driving motor 16. The driving motor 16 includes a stator and a rotor, and the rotor is fixedly connected with the inner drum shaft. A through hole is formed in the center of the rotor, and the water inlet pipeline penetrates through the through hole of the rotor to be communicated with the hollow channel of the inner drum shaft.

[0084] Preferably, a first dynamic sealing structure is arranged between the water inlet pipeline and the through hole of the rotor, and a second sealing structure is arranged between the through hole of the rotor and the hollow channel of the inner drum shaft.

[0085] According to the drum washing machine in the embodiment, the multiple dewatering holes are formed in the side wall of the inner drum 17, and the centrifugal valves are installed on the dewatering holes. The centrifugal valves are opened under the action of the centrifugal force to conduct dewatering and drainage.

Embodiment IV

[0086] The embodiment mainly solves how to keep unbalanced gas pressure of a sealed cabin of a drum washing machine having an inner drum without holes. Specifically, the washing water in the sealed cabin is backflowed to a pipe network due to the fact that feeding water is suddenly cut off by an electromagnetic valve, particularly feeding water is cut off by a tap water pipe network, and negative pressure is formed; or water is difficult to enter into the inner drum due to gas existing inside.

[0087] As shown in Fig. 8-Fig. 12, the drum washing machine of the embodiment includes an inner drum 17 which is without holes and is used for containing washing water when laundry are washed. The drum washing machine includes a pressurization mechanism and/or a depressurization mechanism which are/is used for connecting the inner drum with the external environment so as to balance gas pressure in the inner drum 17.

[0088] The pressurization mechanism of the embodiment includes a pressurization hole channel 28 and a negative pressure safety valve 29, and the negative pressure safety valve 29 is arranged in the pressurization hole channel 28 and used for opening the pressurization hole channel 28 unidirectionally when the internal pressure of the inner drum 17 is smaller than the atmospheric pressure of the external environment, and external environment gas enters the inner drum 17 through the pressurization hole channel 28 to increase the pressure. The negative pressure safety valve 29 is not closed until the internal gas pressure of the inner drum 17 is balanced with the gas pressure of the external environment.

[0089] The depressurization mechanism of the embodiment includes a depressurization hole channel 30 and a positive pressure safety valve 31. The depressurization hole channel 30 is formed in the position, close to the rotating center shaft, of the inner drum 17 and is higher than the highest water level position in the inner drum 17. The positive pressure safety valve 31 is arranged in the depressurization hole channel 30, and used to open unidirectionally the depressurization hole channel 30 for depressurization when the internal pressure of the inner drum 17 is larger than the gas pressure of the external environment. The positive pressure safety valve 31 is not closed until the internal gas pressure of the inner drum 17 is balanced with the gas pressure of the external environment.

[0090] As shown in Fig. 9, when feeding water, gas in a sealed cabin of the inner drum 17 is pressed. Once the gas pressure is larger than a set value of the positive pressure safety valve, the positive pressure safety valve is opened and gas can overflow through the depressurization hole channel, so that the gas pressure balance is ensured.

[0091] As shown in Fig. 10, when feeding water is suddenly cut off, gas in a sealed cabin of the inner drum 17 is pressed. Once the gas pressure is smaller than a set value of the positive pressure safety valve, external atmosphere can quickly enter the sealed cabin and destroy suck-back, gas pressure balance is kept, and washing water is prevented from being sucked into a tap water pipe network.

[0092] In the other conditions, for example, during dewatering, the gas pressure balance mechanism can also keep the gas pressure balance of the inner drum.

[0093] The drum washing machine of the embodiment includes a driving motor 16 and an inner drum shaft 13, and the driving motor 16 is in transmission connection with the inner drum 17 through the inner drum shaft 13 to drive the inner drum 17 to rotate. The pressurization hole channel 28 and/or the depressurization hole channel 30 are/is formed in the inner drum shaft 13 and connects the interior of the inner drum 17 with the external environment, and the highest water level in the inner drum 17 is lower than the inner drum shaft 13.

[0094] The drum washing machine of the embodiment includes an outer drum 18, and the inner drum 17 is arranged in the outer drum 18. Water discharged from the inner drum 17 is discharged through the outer drum 18. An inner drum door 6 for closing the inner drum is installed at a drum opening of the inner drum 17. A drum opening of the outer drum 18 is open. One end of the pressurization hole channel 28 or the depressurization hole channel 30 is communicated with the interior of the inner drum 17, and the other end is arranged in the outer drum 18 and communicated with the outer drum 18.

[0095] The drum washing machine of the embodiment includes a water inlet pipeline. A hollow channel 14 communicating with the interior of the inner drum 17 is formed in the inner drum shaft 13, and the water inlet pipeline is communicated with the hollow channel 14 of the inner drum shaft 13. The depressurization hole channel 30 and the hollow channel 14 are respectively communicated with the interior of the inner drum 17 and are arranged in interval.

[0096] As shown in Fig. 9 and Fig. 10, the hollow channel 14 extends from one end to the other end along the central axis direction of the inner drum shaft 13. The depressurization hole channel 30 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 is communicated with the interior of the inner drum. one end of the second hole channel section is communicated with the first hole channel section, and the other end passes through the outer peripheral wall of the inner drum shaft and is communicated with the interior of the outer drum.

preferably, the second hole channel section is perpendicular to the first hole channel section to form an depressurization hole channel with L-shape.

[0097] The drum washing machine of the embodiment includes a water inlet pipeline. A hollow channel 14 communicating with the interior of the inner drum 17 is formed in the inner drum shaft 13, and the water inlet pipeline is communicated with the hollow channel 14 of the inner drum shaft 13; and the pressurization hole channel 28 is communicated with the hollow channel 14.

[0098] Further, the hollow channel 14 extends from one end to the other end in the direction of the central axis of the inner drum shaft 13. One end of the pressurization hole channel 28 is communicated with the hollow channel 14, and the other end of the pressurization hole channel 28 passes through the peripheral wall of the inner drum shaft 13 to be communicated with the interior of the outer drum 18.

[0099] Preferably, the pressurization hole channel 28 and the hollow channel 14 are perpendicular to each other.

[0100] The inner drum shaft of the embodiment is connected with a driving motor. The driving motor includes a stator and a rotor, and the rotor is fixedly connected with the inner drum shaft. A through hole is formed in the center of the rotor, and the water inlet pipeline penetrates through the through hole of the rotor to be communicated with the hollow channel of the inner drum shaft.

[0101] Preferably, a first dynamic sealing structure is arranged between the water inlet pipeline and the through hole of the rotor, and a second sealing structure is arranged between the through hole of the rotor and the hollow channel of the inner drum shaft.

[0102] As shown in Fig. 11 and Fig. 12, a pressurization hole channel 28 and a depressurization hole channel 30 are both arranged on the inner drum shaft 13. Openings communicating with the atmosphere are both formed in the inner side of the outer drum 18; and Openings communicating the sealed cabin of the inner drum 17 are both arranged on the inner side of the hollow channel 14 of the inner drum shaft 13.

[0103] Preferably, the pressurization hole channel 28 and the depressurization hole channel 30 are both arranged on the inner drum shaft 13. Openings communicating with the atmosphere are both arranged on the inner side of the outer drum 18; and openings communicating the sealed cabin of the inner drum 17 are both arranged on the inner side of the sealed cabin.

Embodiment V

[0104] As shown in Figs 13-16, the drum washing machine of the embodiment includes an inner drum 17 which is without holes and is used for containing washing water when laundry are washed. The drum washing machine further includes a position detection device used for detecting the position of the inner drum.

[0105] The drum washing machine of the embodiment includes a driving motor 16 and an inner drum shaft 13. The driving motor 16 includes a stator and a rotor, and the rotor is fixedly connected with the inner drum shaft 13 to drive an inner drum 17 to rotate. The position detection device includes a position sensor 33 and a detected terminal 38, the detected terminal 38 is arranged on the rotor, and the position sensor 33 is fixed at a position corresponding to the detected terminal 38.

[0106] The drum washing machine of the embodiment includes an outer drum 18. The position sensor 33 is arranged on the side, close to the driving motor 16, of the outer drum 18, and the position sensor 33 and the detected terminal 38 are correspondingly arranged in in-

terval.

[0107] As an implementation mode of the embodiment, the position sensor is an electromagnetic position sensor, a photoelectric position sensor, a differential voltage type sensor, an eddy current type sensor, a capacitance type sensor, a reed switch type sensor, or a Hall type sensor.

[0108] The drum washing machine of the embodiment includes a locking mechanism 35 used for locking rotation of the inner drum. The position detection device is used for detecting whether the inner drum 17 is locked in appropriate place after the locking mechanism 35 locks the inner drum 17, and/or when the position detection device detects that the inner drum 17 rotates to a set position, the locking mechanism 35 locks the inner drum 17.

[0109] Further, the locking mechanism 35 is installed on the side wall, close to the driving motor 16, of the outer drum 18. The locking mechanism 35 includes a locking rod 40 moving in a telescopic mode and a locking motor 41 driving the locking rod 40 to move in a telescopic mode. A rotor of the driving motor 16 is provided with a locking groove 39 corresponding to the locking rod 40 and matched with the locking rod 40. When the locking rod 40 is driven by the locking motor 41 to stretch out and be inserted into the locking groove 39, the inner drum 17 is locked.

[0110] According to the drum washing machine of the embodiment, an inner drum drainage hole is formed in the side wall of an inner drum 17, a one-way valve plug 11 which is normally closed is installed on the inner drum drainage hole, and a pushing rod mechanism 10 used for ejecting the one-way valve plug open for drainage is installed on the outer drum. After the locking mechanism 35 locks the inner drum 17, the pushing rod mechanism 10 ejects the one-way valve plug 11 open for drainage.

[0111] Further, the pushing rod mechanism is installed on the outer drum. The pushing rod mechanism includes a pushing rod moving telescopically and a motor driving the pushing rod to move telescopically. The pushing rod penetrates through the drum wall of the outer drum and is inserted into the drainage hole of the inner drum to eject the one-way valve plug open for drainage.

[0112] The drum washing machine of the embodiment includes a main controller. The position detection sensor, the locking motor and the pushing rod motor for driving the pushing rod are all electrically connected with the main controller.

[0113] According to the drum washing machine of the embodiment, a plurality of dewatering holes are formed in the side wall of the inner drum, and the centrifugal valves are installed on the dewatering holes. The centrifugal valves are opened under the effect of dewatering centrifugal force to conduct dewatering and drainage.

[0114] The washing machine of the embodiment is provided with a position sensor 33 which is arranged on the outer drum 18 or the driving motor 16. And particularly the position sensor 33 is arranged on the rear portion of the outer drum 18 and a rotor framework for rotation of the driving motor 16.

[0115] The position sensor 33 detects the position of the detected terminal 38 on the rotating rotor framework, converts the position into a signal and feeds the signal back to the main controller 4 of the washing machine through a circuit 43.

[0116] The position of the detected terminal 38 on the rotor framework corresponds to the position of the rotating inner drum.

[0117] The washing machine of the embodiment is provided with a mounting bracket 32. A fixing knot 34 is fixed on the rear the outer drum. A locking motor, a locking rod and a position sensor are mounted on the mounting bracket 32. The rotor framework of the driving motor is provided with the locking groove and the detected terminal 38.

Embodiment VI

[0118] As shown in Fig. 17-18, the drum washing machine of the embodiment includes an inner drum 17 and an outer drum 18. The inner drum 17 is without holes and contains washing water when laundry are washed. The outer drum 18 is coaxially arranged outside the inner drum 17 and used for collecting water discharged from the inner drum 17 and discharging the water through a drainage pipeline. The drum washing machine further includes a position detection device which is arranged on the outer drum 18 and used for detecting the position of the inner drum.

[0119] Further, the position detection device includes a position sensor 33 and a detected terminal 38. The detected terminal 38 is arranged on the inner drum 17, and the position sensor 33 is arranged on the inner wall of the outer drum 18 and corresponds to the detected terminal 38 on the inner drum 17.

[0120] Preferably, the detected terminal 38 is arranged on the side wall of the inner drum 17, and the position sensor 33 is arranged on the inner side wall of the outer drum 18. The circumference of the inner drum 17 where the detected terminal 38 is arranged and the circumference of the outer drum 18 where the position sensor 33 is arranged are concentrically arranged.

[0121] Preferably, the position sensor 33 is arranged on the inner side wall of the upper portion of the outer drum 18.

[0122] Preferably, the position sensor is an electromagnetic position sensor, a photoelectric position sensor, a differential voltage type sensor, an eddy current type sensor, a capacitance type sensor, a reed switch type sensor, or a Hall type sensor.

[0123] The drum washing machine of the embodiment includes a locking mechanism 35 used for locking the inner drum for not rotating. The position detection device is used for detecting whether the inner drum 17 is locked in appropriate place after the locking mechanism 35 locks the inner drum 17, and/or when the position detection device detects that the inner drum 17 rotates to a set

position, the locking mechanism 35 locks the inner drum.

[0124] Further, the locking mechanism 35 is installed on the outer drum 18. The locking mechanism 35 includes a locking rod 40 moving telescopically and a locking motor 41 for driving the locking rod 40 to move telescopically. A locking groove 39 matched with the locking rod 40 is formed on the inner drum 17 corresponding to the locking rod 40. When the locking rod 40 is driven by the locking motor 41 to stretch out and be inserted into the locking groove 39, the inner drum 17 is locked.

[0125] As shown in Fig. 8, as one implementation mode of the embodiment, a lifting rib 43 is mounted at the locking groove 39, so that the locking groove 39 is hidden. Further, or the detected terminal 38 is installed in the lifting rib 43.

[0126] As one implementation mode of the embodiment, an inner drum drainage hole is formed in the side wall of the inner drum 17, and a one-way valve plug 11 which is normally closed is installed on the inner drum drainage hole. A pushing rod mechanism 10 used for ejecting the one-way valve plug 11 open for drainage is installed on the outer drum 18. After the locking mechanism 35 locks the inner drum 17, the pushing rod mechanism 10 ejects the one-way valve plug 11 open for drainage.

[0127] Further, the pushing rod mechanism 10 is installed on the outer drum 18. The pushing rod mechanism 10 includes a pushing rod moving telescopically and a motor driving the pushing rod to move telescopically. The pushing rod penetrates through the drum wall of the outer drum to be inserted into the drainage hole of the inner drum to eject the one-way valve plug open for drainage.

[0128] The drum washing machine of the embodiment includes a main controller 4.,The position detection sensor, the locking motor and the motor for driving the pushing rod are all electrically connected with the main controller.

[0129] According to the drum washing machine of the embodiment, a plurality of dewatering holes are formed in the side wall of the inner drum, and the centrifugal valves are installed on the dewatering holes. The centrifugal valves are opened under the effect of dewatering centrifugal force to conduct dewatering and drainage.

Embodiment VII

[0130] As shown in Fig. 19 and Fig. 20, the washing machine in the embodiment includes an inner drum 17 and an inner drum door 6, the inner drum 17 is provided with an inner drum opening, and the inner drum door 6 is installed on the inner drum opening of the inner drum in an opened/closed manner. The washing machine further includes a position detection device used for detecting whether the body of the inner drum door is successfully closed, the situation that the body of the inner drum door is unlocked and water leakage is caused under the washing or rinsing and dewatering situation is avoided. Or the problem is solved, such as the body of the inner drum door is not successfully locked and damage is caused under rotation at a high speed due to negligence of a user.

[0131] The position detection device includes a position sensor 33 and a detected terminal 38. The detected terminal 38 is arranged on the inner drum door 6, and the position sensor 33 is arranged at the position corresponding to the detected terminal 38. The position sensor 33 is fixed, and the detected terminal 38 moves along with the inner drum door 6 in the opening/closing process of the inner drum door 6. The position between the detected terminal 38 an the position sensor 33 changes along with rotation of the inner drum door 6, a generated signal value changes, and the washing machine judges whether the inner drum door 6 is successfully closed according to the received signal value.

[0132] The inner drum door 6 is provided with a locking structure used for being buckled with the inner drum 17, and the detected terminal 38 is arranged on the locking structure.

[0133] The washing machine further includes an outer drum 18 which is arranged outside the inner drum 17 in a sleeving mode and is coaxial with the inner drum 17, and the position sensor 33 is arranged on the outer drum 18 and corresponds to the position of the detected terminal 38. Preferably, the position sensor 33 is arranged on the outer wall of the outer drum 18 and corresponds to the position of the detected terminal 38. The position sensor 33 is fixed, the detected terminal 38 moves along with the inner drum door 6 in the opening/closing process of the inner drum door 6. The position between detected terminal 38 an the position sensor 33 changes along with rotation of the inner drum door 6, and a generated signal value changes. The drum washing machine judges whether the inner drum door 6 is successfully closed according to the received signal value.

[0134] The washing machine further includes a shell 19, the inner drum 17 is arranged in the shell 19, and the position sensor 33 is arranged on the shell 19 and corresponds to the position of the detected terminal.

[0135] The position detection device is an electromagnetic position sensor and includes a permanent magnet rotor and an electromagnetic sensor. The permanent magnet rotor is the detected terminal 38, and the electromagnetic sensor is the position sensor 33. Alternatively the position detection device is a photoelectric position sensor which includes a shading plate and a photoelectric sensor. The shading plate is the detected terminal 38, and the photoelectric sensor is the position sensor 33. Alternatively the position detection device is a differential voltage type sensor which includes an armature and a differential voltage sensor. The armature is the detected terminal 38, and the differential voltage sensor is the position sensor 33. Alternatively the position detection device is an eddy current type sensor which includes a metal plate and an eddy current sensor. The metal plate is the detected terminal 38, and the eddy current sensor is the position sensor 33. Alternatively the

position detection device is a capacitive sensor which includes a moving electrode, a fixed electrode and a capacitive sensor. The moving electrode is the detected terminal 38, and the fixed electrode and the capacitive sensor are the position sensor 33. Alternatively the position detection device is a reed switch type sensor which includes a magnet and a reed switch sensor. The magnet is the detected terminal 38, and the reed switch sensor is the position sensor 33. Alternatively the position detection device is a Hall type sensor which includes a permanent magnet and a Hall sensor. The permanent magnet is the detected terminal 38, and the Hall sensor is the position sensor 33.

[0136] The washing machine further includes a main controller 4, and the main controller 4 is electrically connected with the position sensor.

[0137] The embodiment further includes a control method of the washing machine, comprising the main controller 4 of the washing machine judging whether the inner drum door 6 is successfully closed according to a signal detected by the position detection device. The situation that the inner drum door is unlocked and water leakage is caused under the washing or rinsing and dewatering situation is avoided. Or the problem is solved, such as the door body is not successfully locked and damage is caused under rotation at a high speed due to negligence of a user.

[0138] The signal value responding to a position between the detected terminal 38 and the position sensor 33 when the inner drum door 6 is successfully closed is input into the main controller 4 of the drum washing machine, and as a reference signal value to judge whether the body of the inner drum door is successfully closed.

[0139] When a signal value responding to a position between the detected terminal 38 and the position sensor 33 and received by the main controller 4 of the washing machine is equal to the reference signal value, the main controller 4 of the washing machine judges that the inner drum door 6 is successfully closed. When a signal value which is received by the main controller 4 of the washing machine and responding to a position between the detected terminal 38 and the position sensor 33 is different from the reference signal value, the main controller 4 of the washing machine judges that the inner drum door 6 is not successfully closed, and a user is reminded to close the inner drum door 6. The situation that the inner drum door is unlocked and water leakage is caused under the washing or rinsing and dewatering situation is avoided. Or the problem is avoided, such as the door body is not successfully locked and damage is caused under rotation at a high speed due to negligence of a user.

[0140] The position detection device in the embodiment can be used as an auxiliary device to assist the main controller 4 in judging the rotating state of the inner drum 17 and locking the motor.

Embodiment VIII

[0141] The embodiment of the invention mainly solves the problem of how to automatically and successfully close an inner drum door arranged at a drum opening of an inner drum, and the specific solution is as follows.

[0142] In combination with Fig. 19 and Fig. 21, the washing machine provided by the embodiment includes: a shell 19, an inner drum 17 arranged inside the shell 19 and containing washing water when washing laundry, and an inner drum door 6, installed on a drum opening of the inner drum 17 in an opened/closed manner. The washing machine further includes an inner drum door pushing and closing device 46 which is arranged on the shell 19 and is used for pushing the inner drum door 6 to be closed.

[0143] According to the embodiment, the inner drum door pushing and closing device 46 is arranged on the shell 19, so that the inner drum door 6 can be automatically pushed and closed without manual closing, the automation degree is higher. The problem that the inner drum door 6 is not closed due to negligence of a user can be effectively prevented, and the risk that the inner drum door 6 falls off due to high-speed rotation is avoided.

[0144] Further, the inner drum door pushing and closing device 46 includes a power component and a linkage component which is connected with the power output end of the power component. The power component drives the linkage component to move and act on the inner drum door 6, and the inner drum door 6 is pushed to be closed.

[0145] Further, an opening is formed in the position, corresponding to a drum opening of the inner drum 17, of the shell 19, a machine door 5 capable of being opened and closed is installed on the opening, and the inner drum door pushing and closing device 46 is arranged on the machine door 5 or the side, close to the inner drum door 6, of the shell 19.

[0146] According to one solution, the power component is the machine door 5. The linkage component is a mechanical linkage mechanism connected to the machine door 5. When a user closes the machine door 5, acting force is applied to the machine door 5, and then the machine door 5 drives the mechanical linkage mechanism to act on the inner drum door 6, the inner drum door 6 is closed. Time and labor are saved since the machine door 5 and the inner drum door 6 are closed at the same time. The mechanical linkage mechanism can be a connecting rod mechanism or a linkage folding mechanism.

[0147] Preferably, the inner drum door pushing and closing device 46 is an electric pushing and closing mechanism. Specifically, the power component is a motor arranged in the shell, and the linkage component is a cam mechanism or a cam connecting rod mechanism connected with the power output end of the motor.

[0148] As an alternative solution of the above solution, the power component is an oil pump arranged on the shell 19, and the linkage component is an oil cylinder

connected with the power output end of the oil pump. Or, the power component is a gas pump arranged on the shell, and the linkage component is an air cylinder connected with the power output end of the gas pump.

[0149] In the embodiment, the inner drum door 6 includes a rotating part 611 rotationally connected with the inner drum 17 through a hinge and a pushing and closing part 612 arranged on a side opposite to the rotating part 611. The inner drum door pushing and closing device 46 is arranged on the machine door 5 or the shell 19, corresponding to the pushing and closing part 612. According to the lever principle, the inner drum door pushing and closing device 46 is arranged on the other side away from the rotating part 611, it is more labor-saving and easier to close the inner drum door 6.

[0150] In the embodiment, the inner drum door pushing and closing device 46 is an electric pushing and closing mechanism, so that automatic pushing and closing can be achieved. The controller is electrically connected with the motor or the oil pump or the gas pump through a circuit, it can be achieved that the inner drum door pushing and closing device 46 is electrically controlled, and automation and intelligence are better achieved.

[0151] The washing machine further includes an outer drum 18 located in the shell 19, the inner drum 17 is rotatably arranged in the outer drum 18, and a position detection device is arranged in the outer drum 18 and used for detecting whether the inner drum door 6 is successfully closed. The position detection device includes a detected terminal 38 and a position sensor 33. Preferably, the position sensor 33 is a reed switch type sensor, a Hall sensor, a photoelectric sensor, a differential voltage type sensor, an eddy current type sensor, or a capacitance type sensor. When the washing machine is detected that a machine door 5 is closed and locked, the position detection device detects whether the inner drum door 6 of the washing machine is closed. If yes, a control system of the washing machine controls the inner drum door pushing and closing device 46 to be kept in a closed state; and if not, the inner drum door pushing and closing device 46 is controlled to be started, and the inner drum door 6 is pushed to be closed.

Embodiment IX

[0152] The embodiment mainly solves the problem that a position detection device misjudges that an inner drum door is successfully locked due to the fact that the inner drum door is still closed at an inner drum opening or the opening angle of the inner drum door is very small when the inner drum door of the inner drum without holes of washing machine is actually unlocked, and the specific solution is as follows.

[0153] As shown in Fig. 22 and Fig. 23, the drum washing machine provided by the embodiment includes an inner drum 17 with an inner drum opening. An inner drum door 6 is installed at the inner drum opening in an opened/closed mode. The inner drum door 6 can be connected to the inner drum opening through a connecting piece or buckled to the inner drum opening. The inner drum door 6 needs to be locked through a locking mechanism before the washing machine is started so that accidents caused by high-speed rotation of the inner drum 17 can be prevented. A position detection device, used for detecting whether the inner drum door 6 is successfully locked so as to avoid the situation that a user neglects that the inner drum door 6 is not locked or makes a mistake subjective judgment. The drum washing machine comprises a door closing hindering device 55, used for applying force for hindering closing of the inner drum door 6. When the inner drum door 6 is not locked, the inner drum door 6 is hindered from being closed through the door closing hindering device 55, and the inner drum door 6 is opened by a certain angle A. So when a detected terminal 38 on the inner drum door 6 is not located in a sensing area 54 of the position sensor 33, the position detection device can more accurately judge whether the inner drum door 6 is locked. The problems in the prior art are solved, such as when the inner drum door 6 is not locked, the inner drum door 6 is still closed on the inner drum opening or the opening angle is very small, the position detection device misjudges that the inner drum door 6 is locked. After the washing machine is started, damage or accidents caused by a high rotation speed of the inner drum 17 .

[0154] In the embodiment, the door closing hindering device 55 can be arranged on the inner drum door 6 or on the inner drum 17. Or, the door closing hindering device is arranged between the inner drum door 6 and the inner drum 17. In the embodiment, the door closing hindering device 55 is an elastic piece arranged on the inner drum door 6, on the inner drum 17 or between the inner drum 17 and the inner drum door 6. The elastic piece has certain elasticity. The two elastic ends of the elastic piece abut against the inner wall of the inner drum and the inner wall of the inner drum door. One end of the elastic piece is connected to the inner drum 17 or the inner drum door 6, and the other end of the elastic piece is connected with the inner drum 17 and the inner drum door 6 in an abutting mode. Or the two ends of the elastic piece are connected with the inner drum 17 and the inner drum door 6 in an abutting mode. The elastic piece generates certain resistance when closing the inner drum door 6., And if the inner drum door 6 is not locked, the inner drum door 6 can be bounced open by a certain angle.

[0155] Preferably, the inner drum door 6 is connected to the inner drum opening through an inner drum door shaft 56 in an opened/closed mode. The elastic piece is a torsional spring arranged on the inner drum door shaft 56 in a sleeving mode. The torsion spring includes a torsion spring body with spiral shape, and the torsion spring body is arranged on the inner drum door shaft 56 in a sleeving mode. Two end parts of the torsion spring body extend outwards in a straight line mode to form a front straight line section and a rear straight line section which

are arranged in an included angle mode. The front straight line section and the rear straight line section abut against the inner wall of the inner drum 17 and the inner side wall of the inner drum door 6 respectively. When the inner drum door 6 is closed, the torsion spring generates force for pulling the two sections back to the original positions to prevent the inner drum door 6 from being closed. If the inner drum door 6 is not locked, the torsion spring releases compressed and stored angular energy, and the front straight line section and the rear straight line section act on the inner drum 17 and the inner drum door 6 respectively to generate rotating force to open the inner drum door 6 by a certain angle. When the detected terminal 38 on the inner drum door 6 is located outside the sensing area 54 of the position sensor 33, the position detection device can more accurately judge whether the inner drum door is locked, and the possibility of misjudgment is reduced.

[0156] More preferably, the extension end of the front straight line section of the torsion spring is bent to form a first connecting part used for being connected with the inner drum door 6, and the extension end of the rear straight line section of the torsion spring is bent to form a second connecting part used for being connected with the inner drum 17. The first connecting part and the second connecting part are of hook structures and are hooked to the inner drum door 6 and the inner drum 17. Or the first connecting part and the second connecting part are of spiral structures and are connected to connecting structures correspondingly arranged on the inner drum door 6 and the inner drum 17 in a sleeving mode. The front straight line section and a rear straight line section which are formed by extending two end parts of the torsion spring are connected to the inner drum door 6 and the inner drum 17 in a hooking or sleeving mode respectively. The two end parts of the torsion spring can be stably connected with the inner drum door 6 and the inner drum 17 so that the end parts of the torsion spring are not disengaged from the inner drum door 6 and the inner drum 17.

[0157] In the embodiment, the door closing hindering device 55 is a hydraulic telescopic rod, pneumatic telescopic rod or compression spring, of which one end is connected with the inner wall of the inner drum 17 and the other end is abutted against the inner wall of the inner drum door 6. Alternatively the door closing hindering device 55 is a hydraulic telescopic rod, pneumatic telescopic rod or compression spring, of which one end is connected with the inner wall of the inner drum door 6 and the other end is abutted against the inner wall of the inner drum 17. Alternatively the door closing hindering device 55 is a hydraulic telescopic rod, pneumatic telescopic rod or compression spring which is connected between the inner drum door 6 and the inner drum 17. The door closing hindering device 55 can also be other telescopic and foldable mechanisms capable of generating certain resistance to closing of the inner drum door 6.

[0158] The position detection device in the embodiment includes a detected terminal 38 arranged on the inner drum door 6, and a position sensor 33 arranged corresponding to the detected terminal 38 and provided with a sensing area 54 capable of sensing the detected terminal 38. The drum washing machine further includes an outer drum 18 which is arranged outside the inner drum 17 in a sleeving mode and is coaxial with the inner drum 17. The position sensor 33 is arranged on the outer drum 18 and corresponds to the position of the detected terminal 38. Or the drum washing machine further includes a shell 19 arranged outside the inner drum 17, and the position sensor 33 is arranged on the shell 19 and corresponds to the position of the detected terminal 38.

[0159] According to the embodiment, the inner drum door 6 is locked on the inner drum 17 through a locking mechanism. The locking mechanism includes a locking piece 52 arranged on the inner drum door 6 and a locking groove 53 formed in the inner drum corresponding to the locking piece 52. The detected terminal 38 is arranged on the locking piece 52. Preferably, the locking piece 52 is a lock tongue arranged on the inner drum door 6, and the locking groove 53 is a lock hole formed in the inner drum openin of the inner drum 17.

[0160] In the embodiment, the position detection device is an electromagnetic type sensor, the position sensor 33 is an electromagnetic sensor, and the detected terminal 38 is a permanent magnet rotor. Or the position detection device is a photoelectric type position sensor, the position sensor 33 is a photoelectric sensor, and the detected terminal 38 is a shading plate. Or the position detection device is a differential voltage type sensor, the position sensor 33 is a differential voltage sensor, and the detected terminal 38 is an armature. Or the position detection device is an eddy current type sensor, the position sensor 33 is an eddy current sensor, and the detected terminal 38 is a metal plate. Or the position detection device is Hall type sensor, the position sensor 33 is a Hall sensor, and the detected terminal 38 is a permanent magnet.

[0161] Preferably, the position detection device is a reed switch type sensor, the position sensor 33 is a reed switch sensor, and the detected terminal 38 is a permanent magnet. The detected terminal 38 is arranged at the position, close to the locking piece 52, of the inner drum door 6, and the position sensor 33 is arranged at the position, close to a drum opening of the inner drum 17, of the inner wall of the outer drum 18.

[0162] When a lock tongue on the inner drum door 6 is locked in a lock groove of the inner drum, the inner drum door 6 is locked, then the torsional spring cannot open the inner drum door 6 by a certain angle, so that a permanent magnet located on the inner drum door 6 is located in the sensing area 54 of the reed switch sensor, the reed switch sensor forms a circuit, and a control unit of the washing machine judges that the inner drum door 6 is locked. When the lock tongue is not locked in the lock groove, the inner drum door 6 is unlocked, the force

generated by the torsion spring forcibly opens the inner drum door 6 at an included angle A shown in the Fig. 23, so that the permanent magnet is located outside the sensing area 54 of the reed switch sensor, the reed switch sensor is in an broken circuit at the moment, the control unit of the washing machine judges that the inner drum door is unlocked, and then an alarm is given. A user is reminded to lock the inner drum door.

Embodiment X

[0163] The technical problem solved by the embodiment is the same as that solved by the Embodiment IX, and the technical solution is further optimized on the basis of the solution of the Embodiment IX, and the specific solution is as follows.

[0164] As shown in Figs 24-26, the drum washing machine provided by the embodiment of the invention includes an inner drum 17 with an inner drum opening; an inner drum door 6 mounted at the inner drum opening in an opened/closed manner; a position detection device, used for detecting whether the inner drum door 6 is successfully locked; and a magnetic element, used for attracting/repelling the inner drum door 6 and applying force for hindering closing of the inner drum door 6. According to the embodiment, the non-contact magnetic element is used for hindering closing of the inner drum door. Compared with the door closing hindering device in the Embodiment IX, the friction loss between the non-contact magnetic element and the inner drum door and the friction loss between the non-contact magnetic element and the inner drum are reduced, the damage rate is low, the structure is simple, sensitivity is higher, and controllability is high.

[0165] The magnetic element in the embodiment can be independently arranged and can also be arranged on the washing machine together with the door closing hindering device in the Embodiment IX, so that the double insurance effect is achieved, the probability of misjudgment of the position detection device is further reduced. If one of the door closing hindering device and the magnetic element is only arranged and is broken, the effect of preventing the door body from being closed cannot be achieved. The above accident is prevented by arrangement of magnetic element together with the door closing hindering device.

[0166] In one embodiment, as shown in Fig. 24, the magnetic element includes a first magnetic element 61 arranged on the inner wall of the inner drum door 6 and a second magnetic element 62 arranged at the drum opening of the inner drum 17 corresponding to the first magnetic element 61. The first magnetic element 61 and the second magnetic element 62 repel with each other. When the inner drum door 6 is closed, force for hindering closing of the inner drum door 6 is generated. If the inner drum door 6 is not locked, the repelling force generated by the first magnetic element 61 and the second magnetic element 62 enables the inner drum door 6 to be opened at a certain angle.

[0167] The same magnetic poles of the first magnetic element 61 and the second magnetic element 62 face with each other. More preferably, the first magnetic element 61 and the second magnetic element 62 are two permanent magnets, and the magnetism of the permanent magnets cannot be weakened or disappear, so that the trouble caused by frequent magnetizing is avoided. The inner drum door 6 and the inner drum 17 are provided with installation positions used for installing the first magnetic element 61 and the second magnetic element 62. Fixing can be achieved in a clamping or bonding mode, the structure is simple, and installation is convenient.

[0168] In another implementation mode, the washing machine further includes a shell 19 arranged outside the inner drum 17. The magnetic element includes a first magnetic element 61 arranged on the outer wall of the inner drum door 6 and a second magnetic element 62 arranged on the inner wall of the shell 19 corresponding to the first magnetic element 61. The first magnetic element 61 and the second magnetic element 62 attract each other. When the inner drum door 6 is closed, the second magnetic element 62 arranged on the shell 19 generates magnetic attraction force to the first magnetic element 61 located on the inner drum door 6 so as to attract the inner drum door 6 and hinder closing of the inner drum door 6. If the inner drum door 6 is not locked, the generated attraction force enables the inner drum door 6 to be opened by a certain angle.

[0169] Alternatively, a machine door 5 is arranged at the position, corresponding to the inner drum door 6, of the shell 19. The machine door 5 is connected to the shell 19 through a machine door shaft 57. The magnetic element includes the first magnetic element 61 arranged on the outer wall of the inner drum door 6 and the second magnetic element 62 arranged on the inner wall of the machine door 5 and corresponding to the first magnetic element 61. The first magnetic element 61 and the second magnetic element 62 attract with each other. When the inner drum door 6 is closed, the second magnetic element 62 arranged on the machine door 5 generates magnetic attraction force to the first magnetic element 61 located on the inner drum door 6, then the inner drum door 6 is attracted, and closing of the inner drum door 6 is hindered. If the inner drum door 6 is not locked, the generated attractive force enables the inner drum door 6 to be opened at a certain angle.

[0170] In the above implementation mode, the following two specific solutions are provided.

[0171] According to the first solution, as shown in the Fig. 25, the first magnetic element 61 is a magnetic induction piece or a permanent magnet arranged on the inner drum door 6. The magnetic induction piece can be made of iron, nickel, cobalt and other metal magnetic materials. The second magnetic element 62 is an electromagnetic module arranged on the shell 19 or the machine door 5 corresponding to the first magnetic element 61. The electromagnetic module is an electrified coil or

an electromagnet. The magnetism of the adopted electromagnetic module can be controlled through on-off of current, the intensity of the magnetism can be controlled through the magnitude of the current or the number of turns of a coil, and it is easy to be controlled. The intensity of the magnetism attracting the inner drum door can also be regulated and controlled by controlling the magnitude of the current. The phenomenon is avoided that the inner drum door cannot be attracted due to too weak magnetism, or that the inner drum door is damaged to a certain extent or is difficult to close due to too strong magnetism,. After the position detection device detects that the inner drum door is successfully locked, the control unit of the washing machine controls the electromagnetic module to be powered off, resources are saved. The situation that the magnetic element always generates force for hindering closing of the door body after the inner drum door is locked is avoided, and the sealing effect of the inner drum door is affected.

[0172] According to the second solution, as shown in the Fig. 26, the opposite magnetic poles of the first magnetic element 61 and the second magnetic element 62 face with each other. Preferably, the first magnetic element 61 and the second magnetic element 62 are both permanent magnets. According to the alternative solution of the above solution, the first magnetic element 61 is a magnetic induction piece such as iron, nickel, cobalt and other metal magnetic materials, and the second magnetic element 62 is a permanent magnet. Or, the first magnetic element 61 is a permanent magnet. The second magnetic element 62 is a magnetic induction piece. The combination of the permanent magnet and the magnetic induction piece or the combination of the permanent magnet and the permanent magnet is adopted to generate resistance for preventing the inner drum door 6 from being closed. The inner drum door 6 is opened by a certain angle, and the washing machine is simple in structure, low in cost and strong in applicability.

[0173] As shown in Figs 24 to 26, the position detection device in the embodiment includes a detected terminal 38 arranged on an inner drum door 6; and a position sensor 33 arranged corresponding to the detected terminal 38 and provided with a sensing area 54 capable of sensing the detected terminal. Preferably, the position sensor 33 is a reed switch type sensor. The specific structure, the arrangement position and the arrangement mode of the position sensor in the embodiment are the same as those in the Embodiments VII-IX, and are not repeated here.

[0174] The above is only the preferred embodiments of the invention, and does not limit the invention in any form, although the invention is disclosed by the preferred embodiments, the preferred embodiments are not used for limiting the invention, and any skilled person familiar with the invention can make some changes or modifications as equivalent embodiments by using the technical contents mentioned above without departing from the technical solution of the invention. However, any simple modifications, equivalent changes and modifications made to the above embodiments according to the technical essence of the invention without departing from the technical solution of the invention still belong to the scope of the solution of the invention.

Claims

1. A drum washing machine, comprising :

   an inner drum with an inner drum opening;
   an inner drum door, mounted at the inner drum opening in an opened and closed manner;
   a position detection device, configured to detect whether the inner drum door is locked; and
   a door closing hindering device, configured to apply force for hindering closing of the inner drum door.

2. The drum washing machine according to claim 1, wherein the door closing hindering device is arranged on the inner drum or on the inner drum door; or
   the door closing hindering device is arranged between the inner drum and the inner drum door.

3. The drum washing machine according to claim 1, wherein the door closing hindering device is an elastic piece arranged between the inner drum and the inner drum door, and two elastic ends of the elastic piece abut against the inner drum and the inner drum door.

4. The drum washing machine according to claim 3, wherein the inner drum door is connected to the inner drum opening through an inner drum door shaft, the elastic piece is a torsional spring arranged on the inner drum door shaft in a sleeving mode, the torsional spring comprises a torsional spring body with spiral shape, the torsional spring body is arranged on the inner drum door shaft in a sleeving mode, and two end parts of the torsion spring body extend outwards and respectively abut against the inner drum and the inner drum door.

5. The drum washing machine according to claim 1, wherein the door closing hindering device is a hydraulic telescopic rod, a gas pressure telescopic rod, or t a compression spring.

6. The drum washing machine according to claim 1, wherein the position detection device comprises:

   a detected terminal, arranged on the inner drum door; and
   a position sensor, arranged corresponding to the detected terminal and provided with a sens-

ing area capable of sensing the detected terminal.

7. The drum washing machine according to claim 6, comprising, an outer drum which is arranged outside the inner drum in a sleeving mode and is coaxial with the inner drum, wherein the position sensor is arranged on the outer drum and corresponds to the position of the detected terminal.

8. The drum washing machine according to claim 6, comprising a shell arranged outside the inner drum, wherein the position sensor is arranged on the shell and corresponds to the position of the detected terminal.

9. The drum washing machine according to claim 6, wherein the inner drum door is locked on the inner drum through a locking mechanism, the locking mechanism comprises a locking piece arranged on the inner drum door and a locking groove arranged in the inner drum corresponding to the locking piece, and the detected terminal is arranged on the locking piece.

10. The drum washing machine according to claim 6, wherein the position detection device is an electromagnetic type sensor, the position sensor is an electromagnetic sensor, and the detected terminal is a permanent magnet rotor;

or the position detection device is a photoelectric type position sensor, the position sensor is a photoelectric sensor, and the detected terminal is a shading plate;
or the position detection device is a differential voltage type sensor, the position sensor is a differential voltage sensor, and the detected terminal is an armature;
or the position detection device is an eddy current type sensor, the position sensor is an eddy current sensor, and the detected terminal is a metal plate;
or the position detection device is a Hall type sensor, the position sensor is a Hall sensor, and the detected terminal is a permanent magnet;
or the position detection device is a reed switch type sensor, the position sensor is a reed switch sensor, and the detected terminal is a permanent magnet.

11. The drum washing machine according to any one of claims 1-10, wherein the door closing hindering device comprises a magnetic element which attracts and repels the inner drum door, and applies force for hindering closing of the inner drum door.

12. The drum washing machine according to claim 11, wherein the magnetic element comprises a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged on the inner drum opening, and the first magnetic element and the second magnetic element repel each other;

preferably, same magnetic poles of the first magnetic element and the second magnetic element face with each other; and
more preferably, both the first magnetic element and the second magnetic element are permanent magnets.

13. The drum washing machine according to claim 11, comprising a shell arranged outside the inner drum, wherein the magnetic element comprises a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged on the shell, and the first magnetic element and the second magnetic element attract each other.

14. The drum washing machine according to claim 11, comprising a shell arranged outside the inner drum, wherein a machine door is arranged at the position, corresponding to the inner drum door, of the shell, the magnetic element comprises a first magnetic element arranged on the inner drum door and a second magnetic element correspondingly arranged on the machine door, and the first magnetic element and the second magnetic element attract each other.

15. The drum washing machine according to claim 13 or 14, wherein the first magnetic element is a magnetic induction piece or a permanent magnet arranged on the inner drum door, and the second magnetic element is an electromagnetic module.

16. The drum washing machine according to claim 13 or 14, wherein opposite magnetic poles of the first magnetic element and the second magnetic element face with each other; and
preferably, both the first magnetic element and the second magnetic element are permanent magnets.

17. The drum washing machine according to claim 13 or 14, wherein the first magnetic element is a magnetic induction piece, and the second magnetic element is a permanent magnet; or,
the first magnetic element is a permanent magnet, and the second magnetic element is a magnetic induction piece.

18. The drum washing machine according to claim 11, wherein the position detection device comprises:

a detected terminal, arranged on the inner drum door; and

a position sensor, arranged corresponding to the detected terminal and provided with a sensing area capable of sensing the detected terminal;
preferably, the position sensor is a reed switch sensor.

19. The drum washing machine according to claim 18, comprising an outer drum which is arranged outside the inner drum in a sleeving mode and coaxial with the inner drum, and the position sensor is arranged on the outer drum and corresponds to the position of the detected terminal;
or, the drum washing machine further comprises a shell arranged outside the inner drum, and the position sensor is arranged on the shell and corresponds to the position of the detected terminal.

20. The drum washing machine according to claim 18, wherein the inner drum door is locked on the inner drum through a locking mechanism, the locking mechanism comprises a locking piece arranged on the inner drum door and a locking groove arranged in the inner drum corresponding to the locking piece, and the detected terminal is arranged on the locking piece.

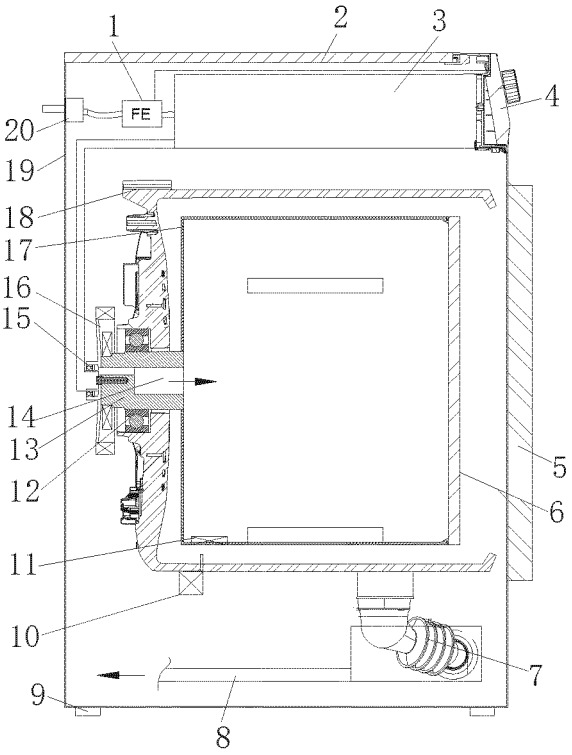
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Fig. 1

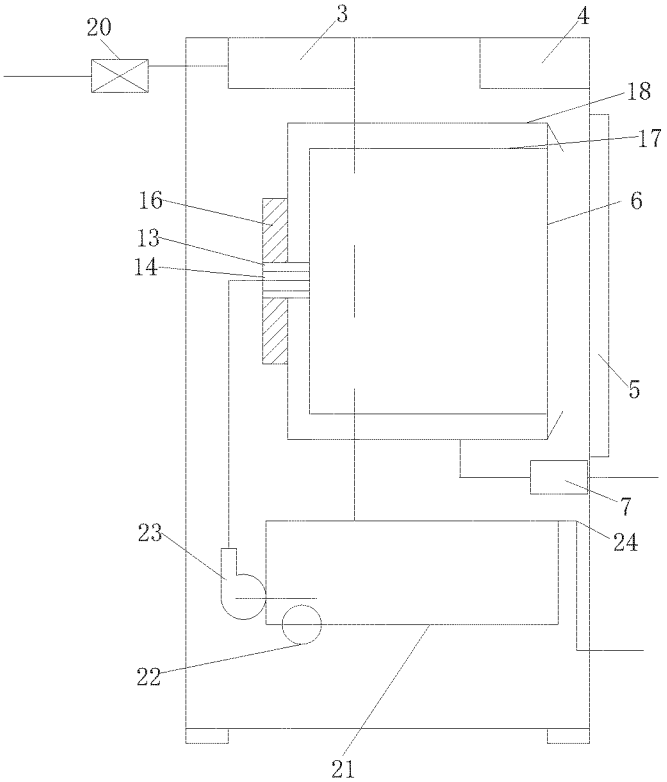
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Fig. 2

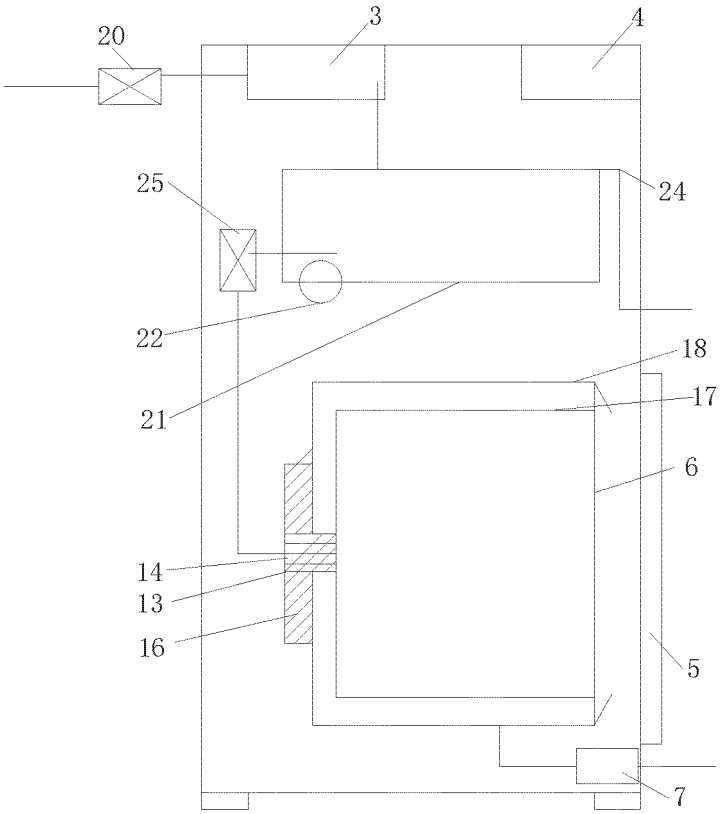
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Fig. 3

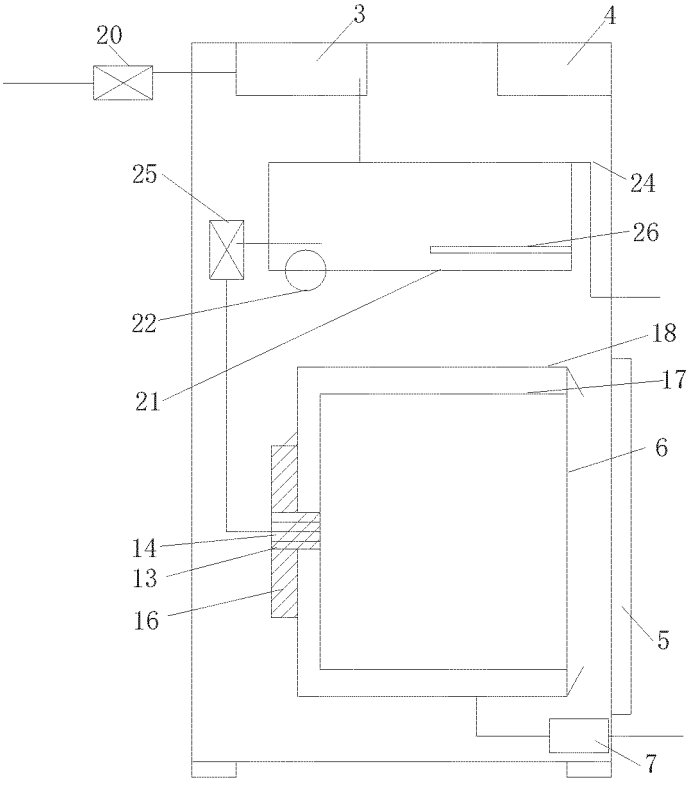
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Fig. 4

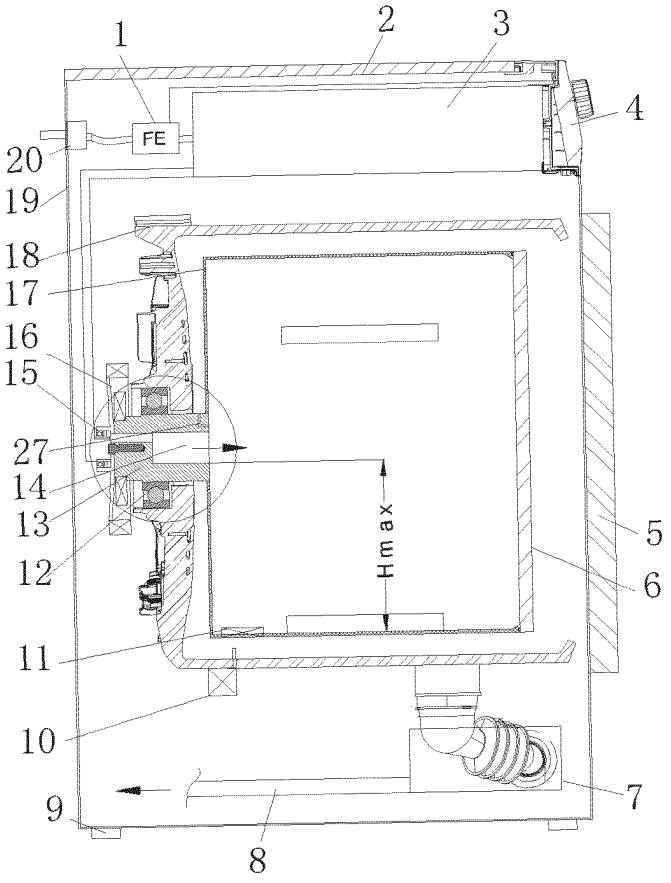
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Fig.5

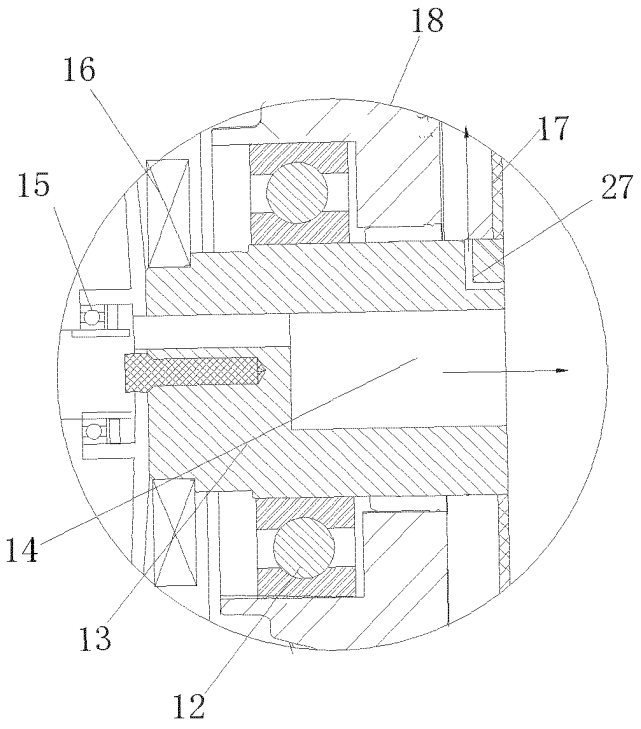
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Fig. 6

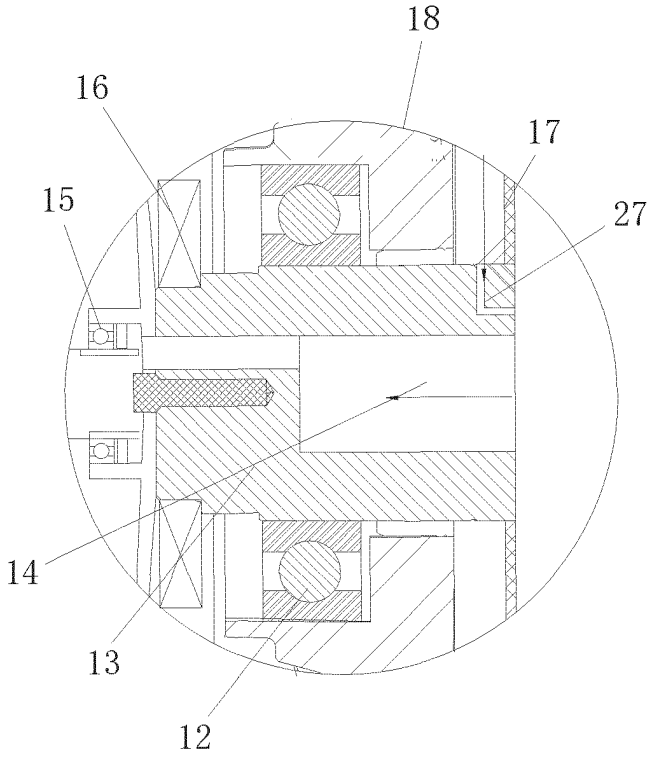
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Fig. 7

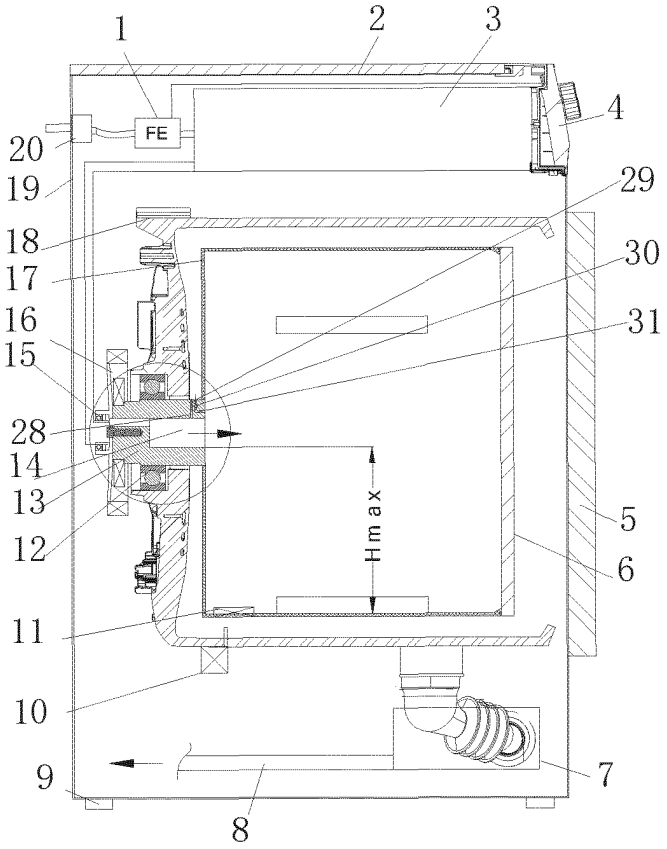
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Fig. 8

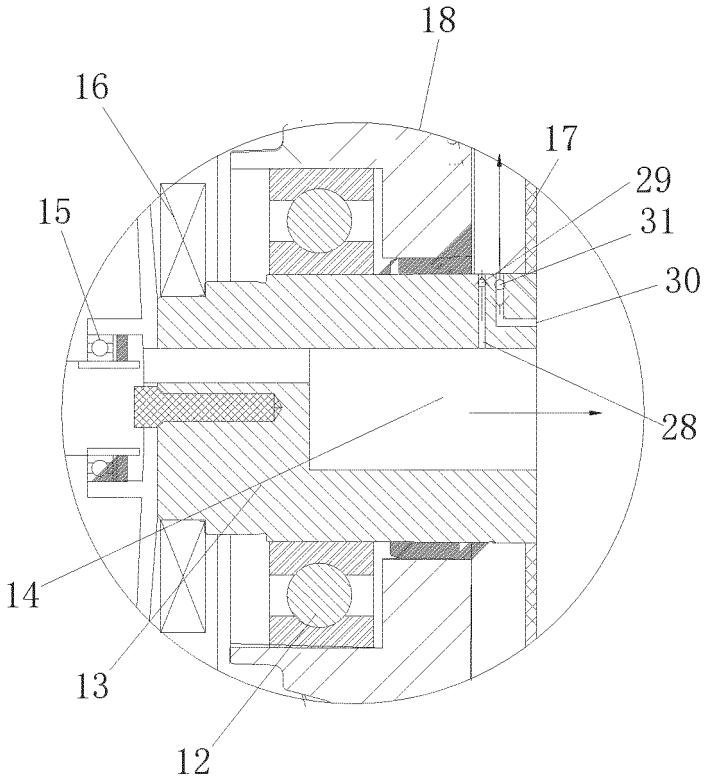

Fig. 9

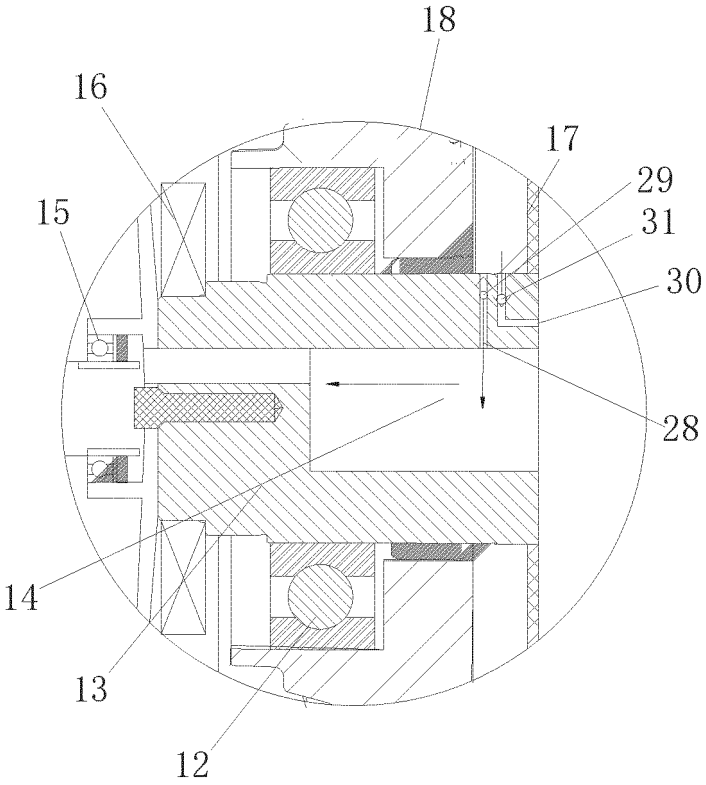

Fig. 10

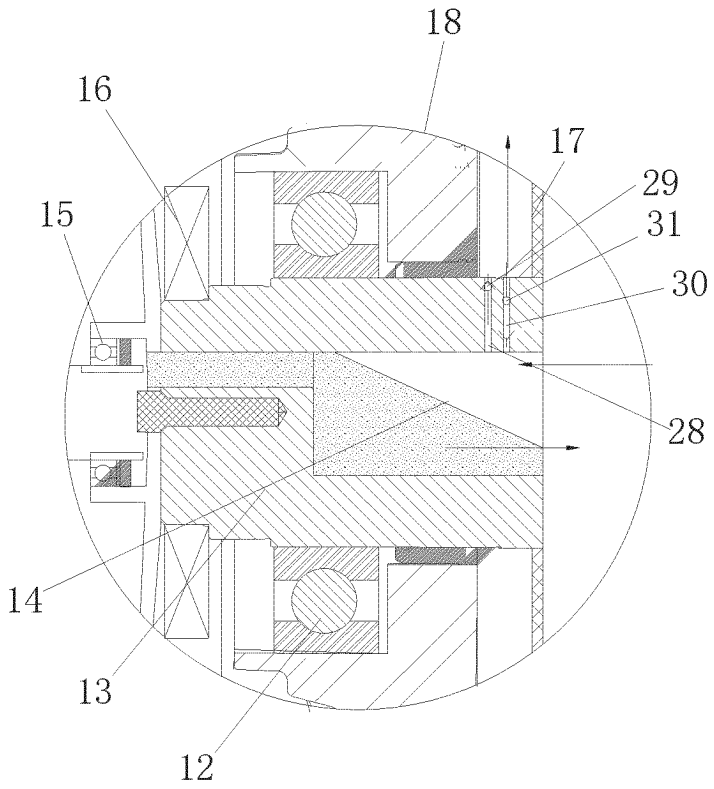

Fig. 11

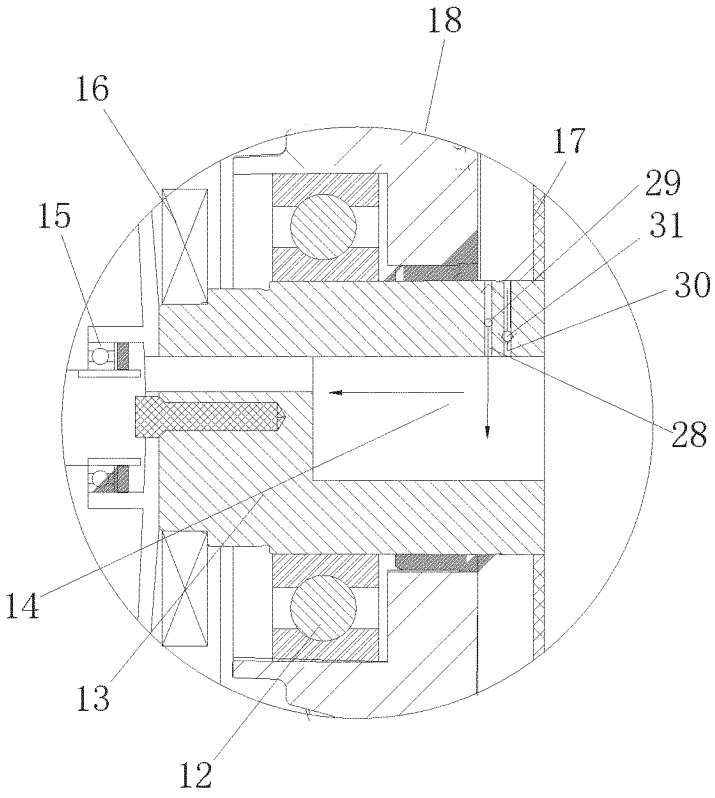

Fig. 12

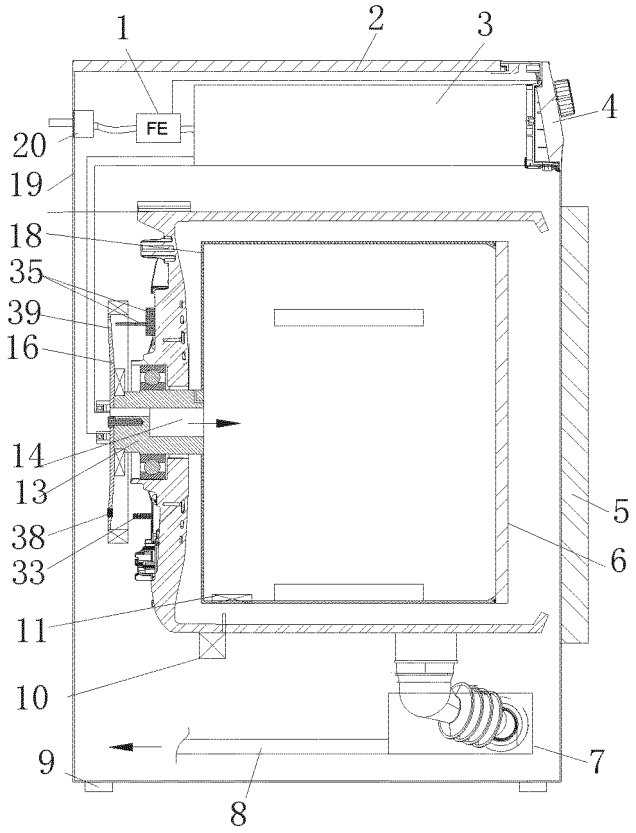
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Fig. 13

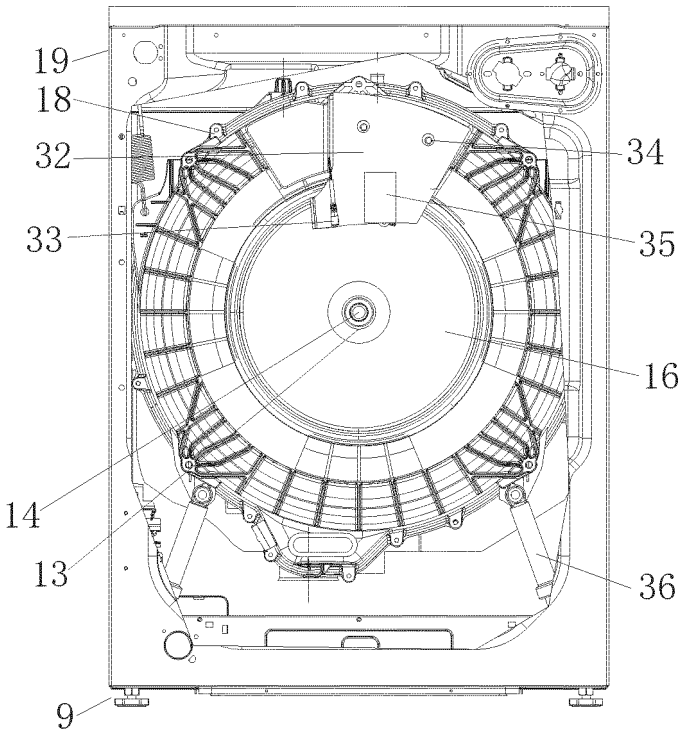
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Fig. 14

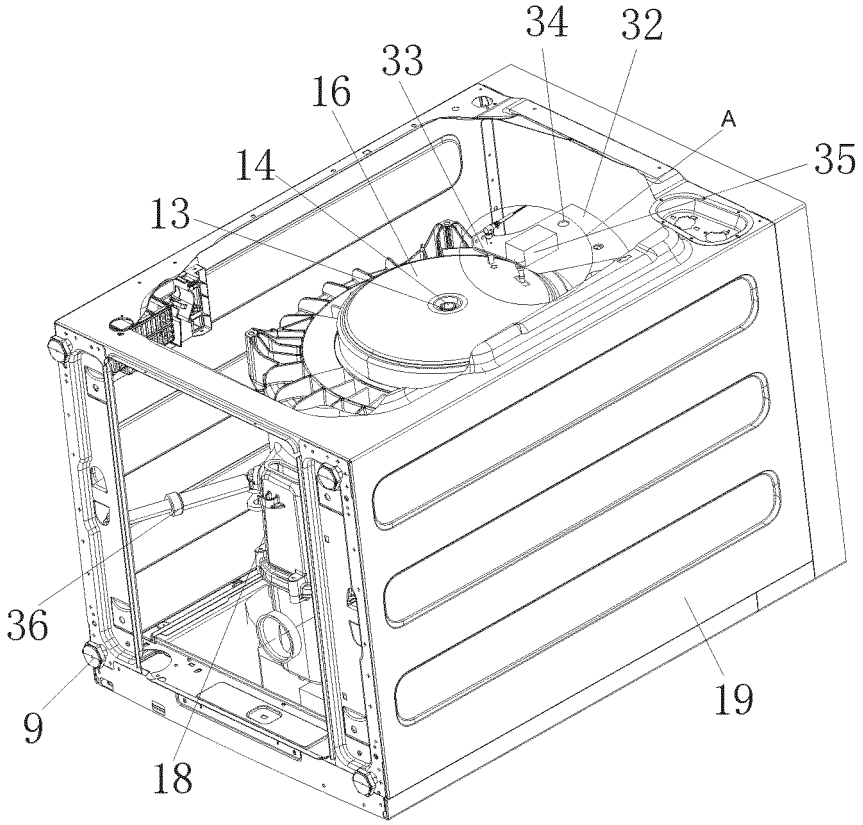

Fig. 15

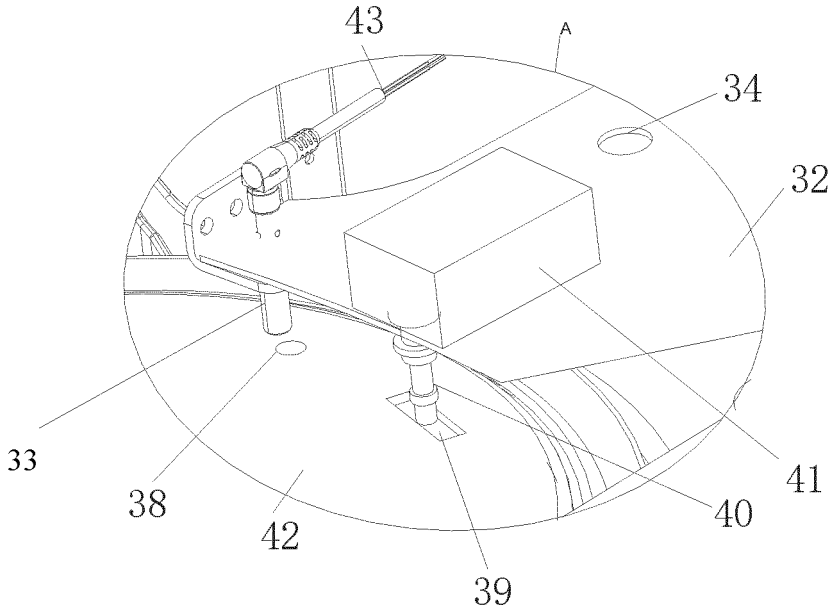

Fig. 16

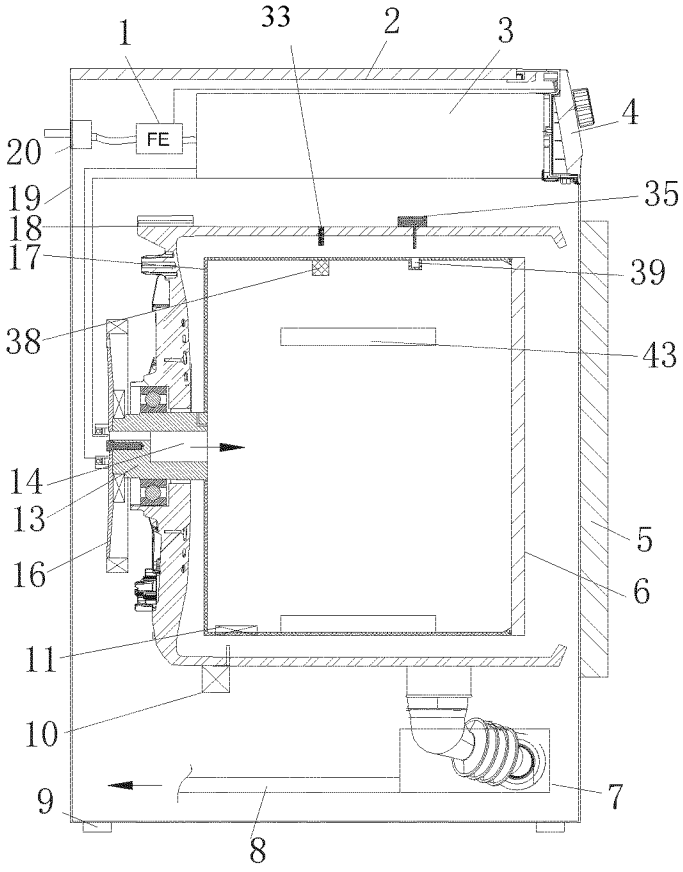
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Fig. 17

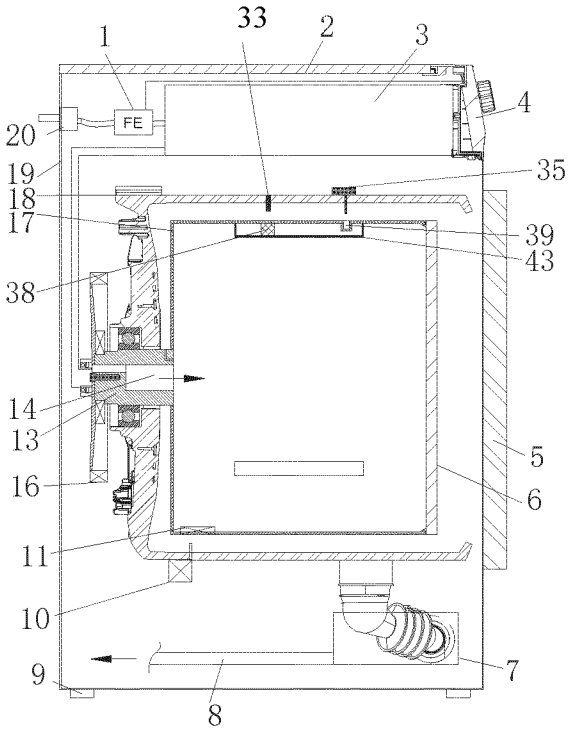
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Fig. 18

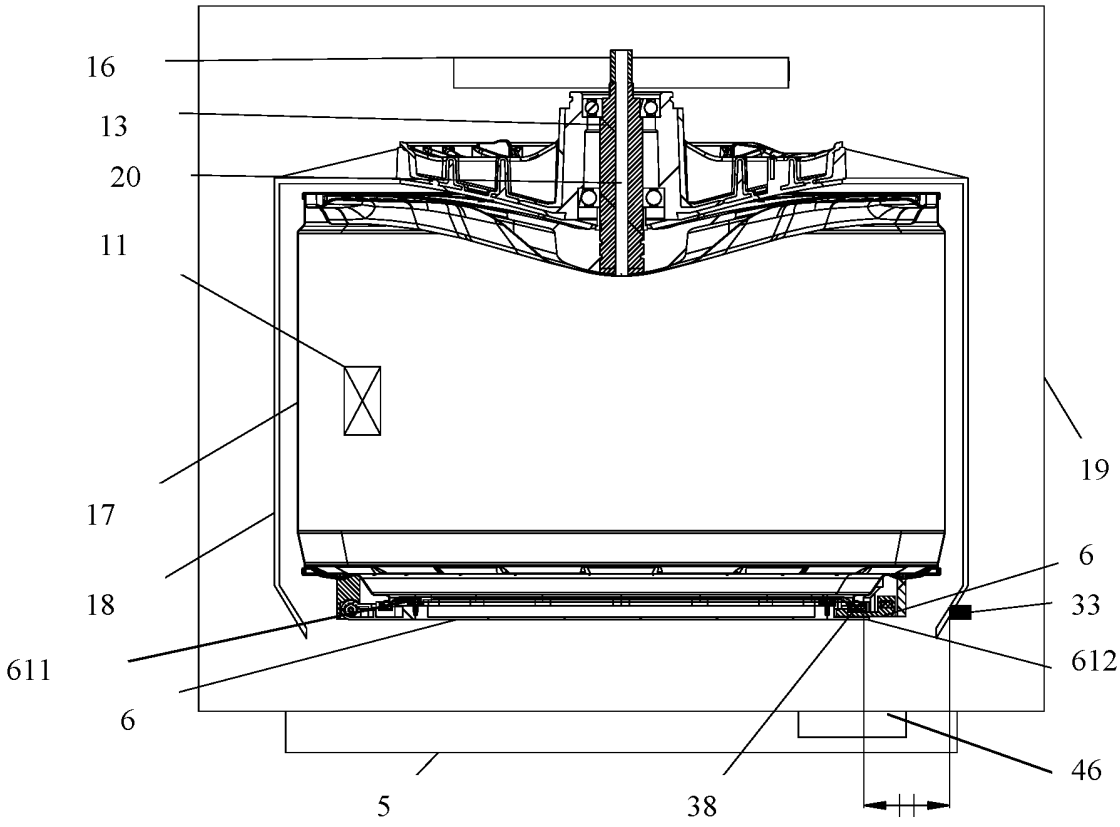

Fig.19

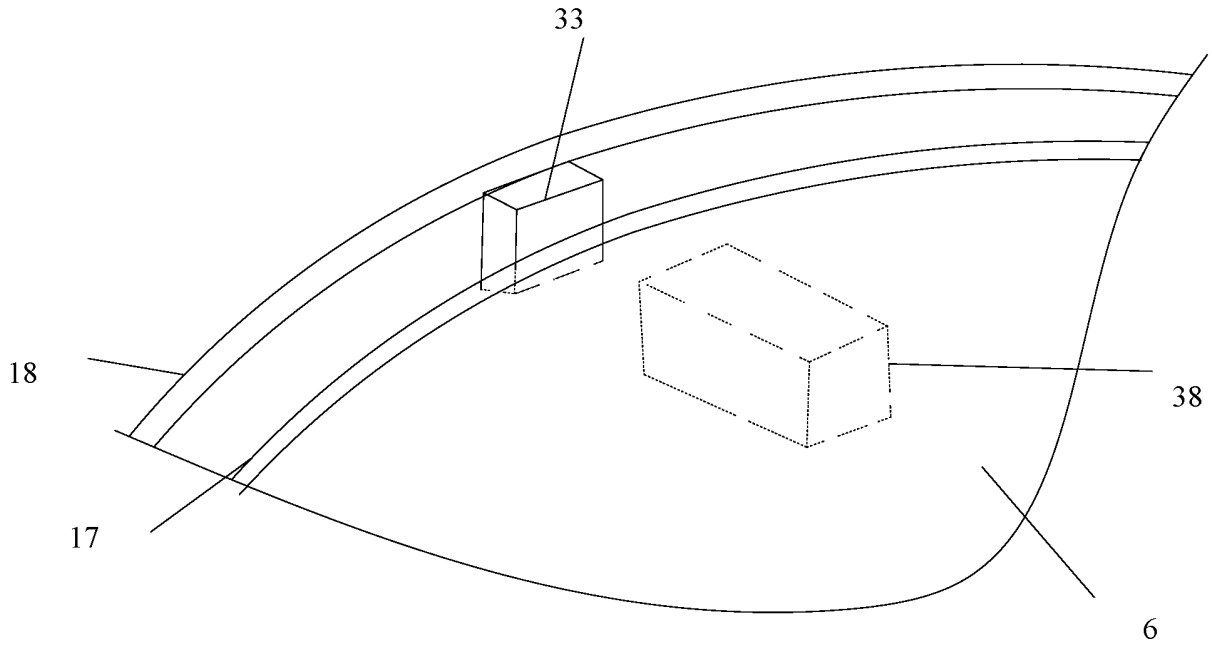

Fig.20

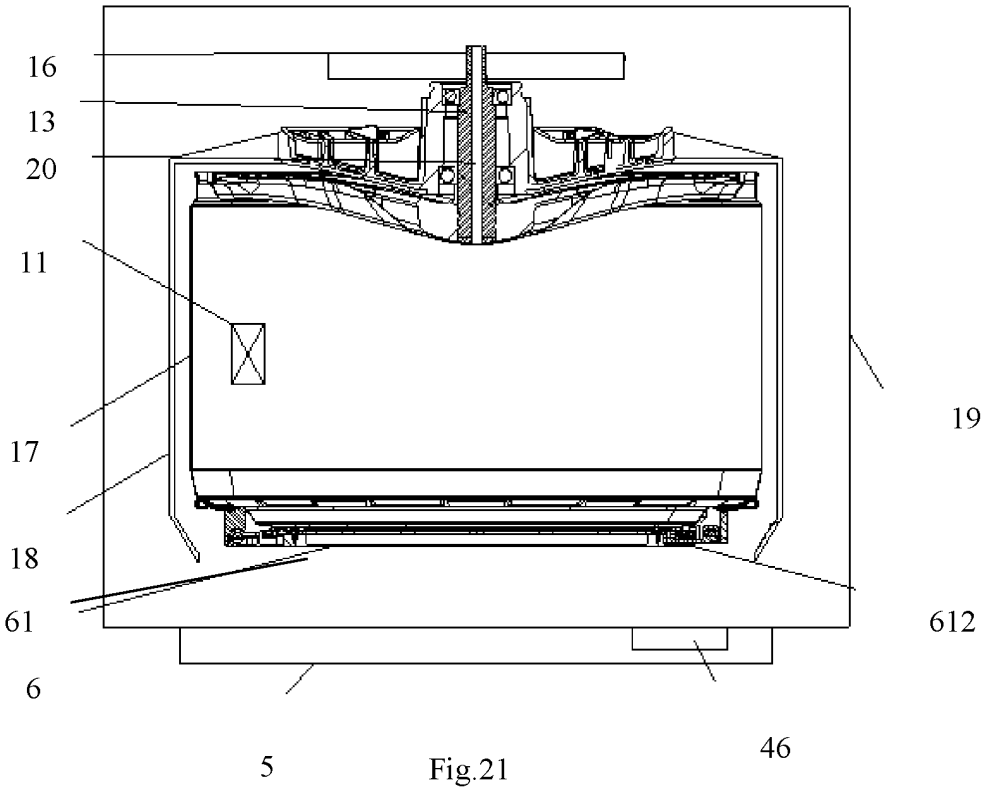

Fig.21

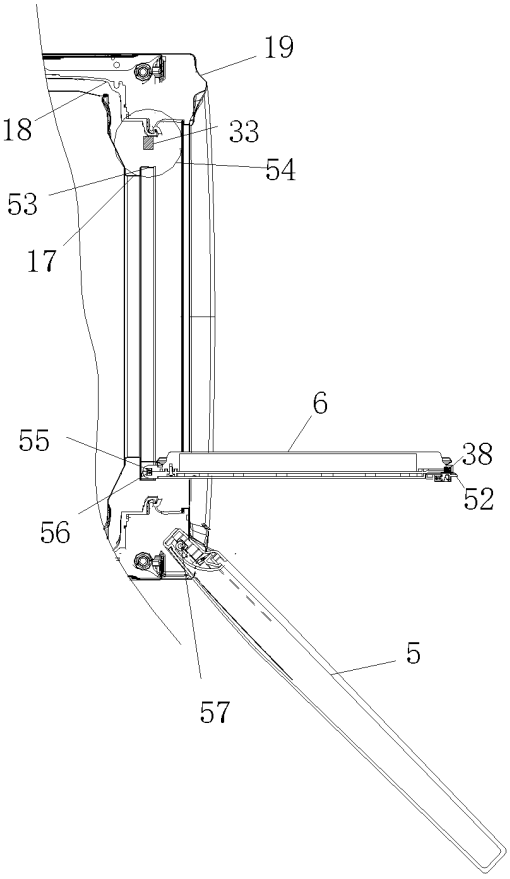

Fig.22

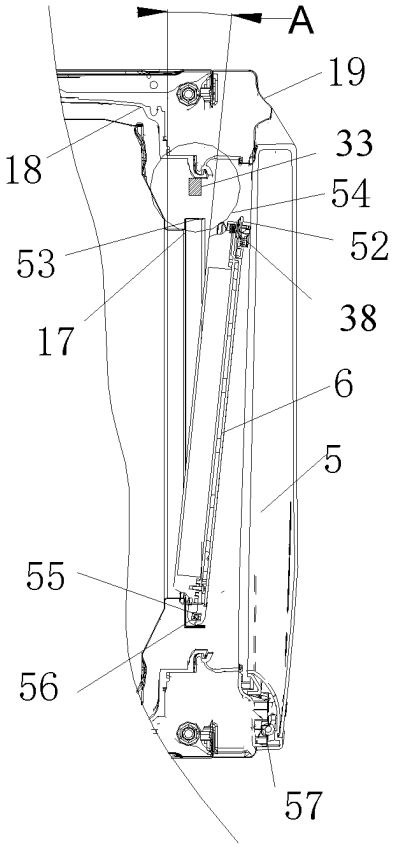
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Fig.23

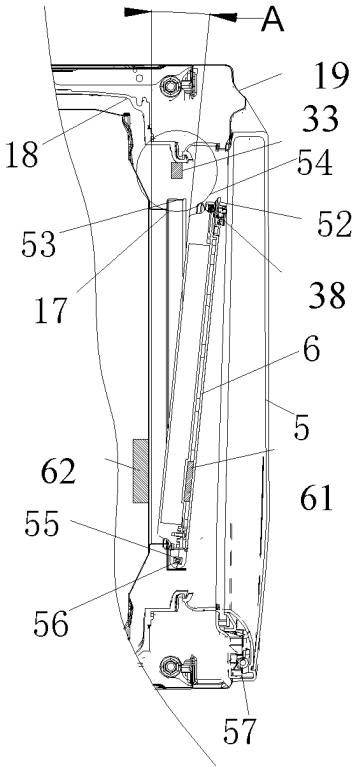
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Fig.24

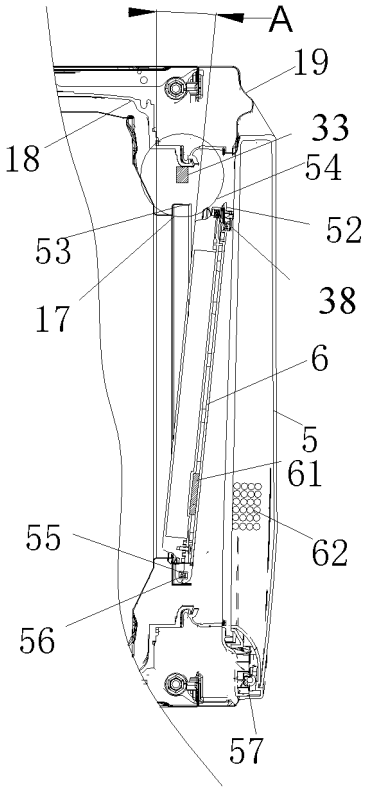
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Fig.25

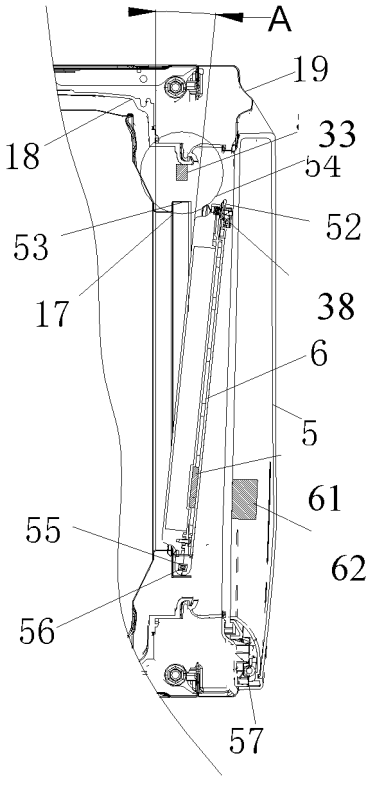
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Fig.26

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2020/097065

A. CLASSIFICATION OF SUBJECT MATTER

D06F 37/10(2006.01)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)

CNPAT, CNKI, EPODOC, WPI: 海尔, 洗衣机, 滚筒, 滚桶, 阻, 防, 盖, 闭, 保持, 维持, 开, 弹簧, 扭簧, 检, 测, 传感器, 磁, arrest+, prevent+, gate, lid, cover+, clos+, shut+, spring, detect+, check+, inspect+, test+, sens+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PY	CN 111088657 A (QINGDAO HAIER DRUM WASHING MACHINE CO., LTD.) 01 May 2020 (2020-05-01) description paragraphs 0041-0068; figures 1-10	1-10
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Y	CN 208604369 U (ANHUI JULONG TRANSMISSION TECHNOLOGY CO., LTD.) 15 March 2019 (2019-03-15) description paragraphs 0044-0063; figures 1-9	1-20
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☑ Further documents are listed in the continuation of Box C. ☑ See patent family annex.

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

Date of the actual completion of the international search	Date of mailing of the international search report
04 September 2020	**23 September 2020**

Name and mailing address of the ISA/CN	Authorized officer
China National Intellectual Property Administration (ISA/CN) **No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088** **China**	
Facsimile No. **(86-10)62019451**	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
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C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 2007307067 A (SHARP K.K.) 29 November 2007 (2007-11-29) entire document	1-20
A	DE 102017011271 A1 (DIEHL AKO STIFTUNG GMBH & CO.) 13 June 2019 (2019-06-13) entire document	1-20

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