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KIM et al.

(54) **CLOTHES TREATMENT APPARATUS, AND CONTROL METHOD FOR CLOTHES TREATMENT APPARATUS**

(71) Applicant: **LG ELECTRONICS INC.**, Seoul (KR)

(72) Inventors: **Kyunghoon KIM**, Seoul (KR); **Suncheol BAE**, Seoul (KR); **Junghun KIM**, Seoul (KR); **Younghan CHO**, Seoul (KR); **Inwoo HAN**, Seoul (KR)

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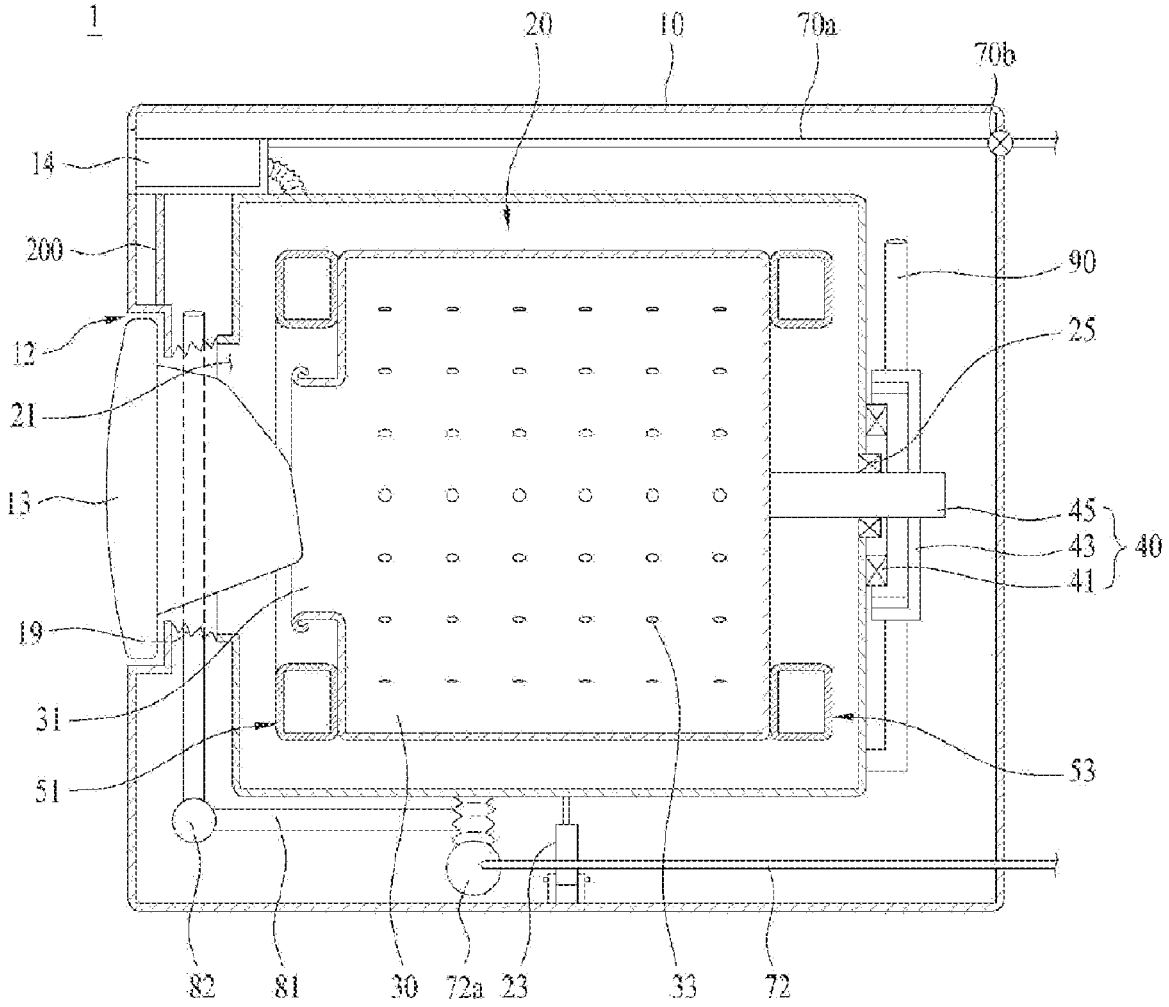
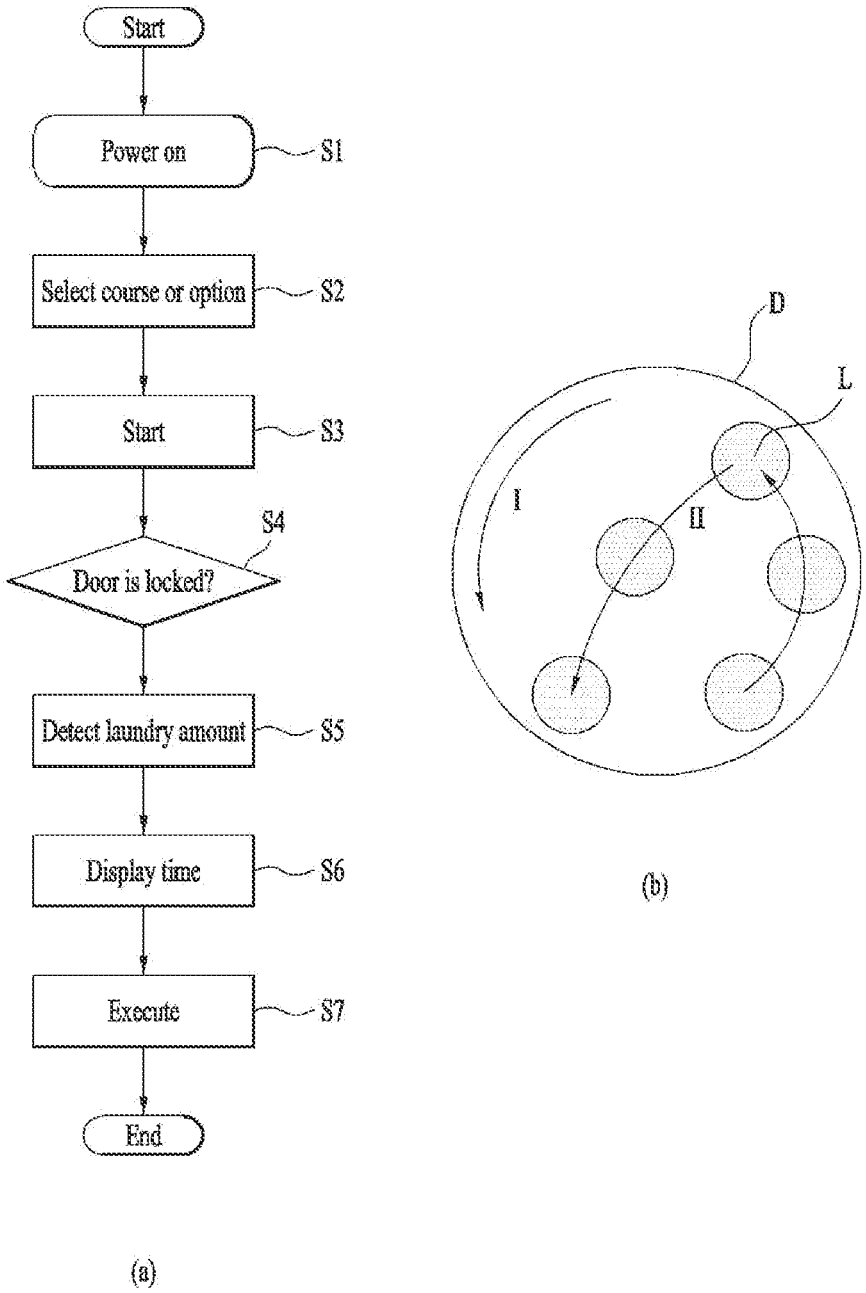
(57) **ABSTRACT**

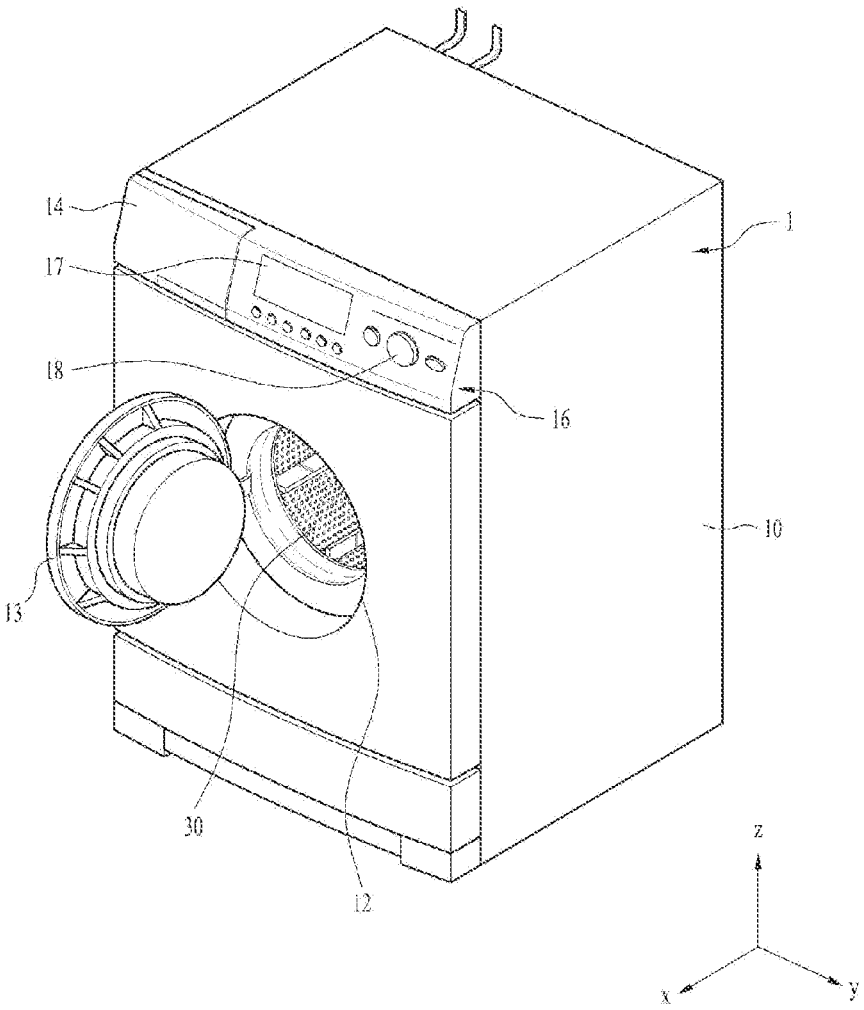
The present invention relates to a clothes treatment apparatus and a control method therefor, the apparatus being capable of receiving a command that changes the execution time of a course or option for performing washing or drying, and being capable of extending or shortening the execution time if the command is input.



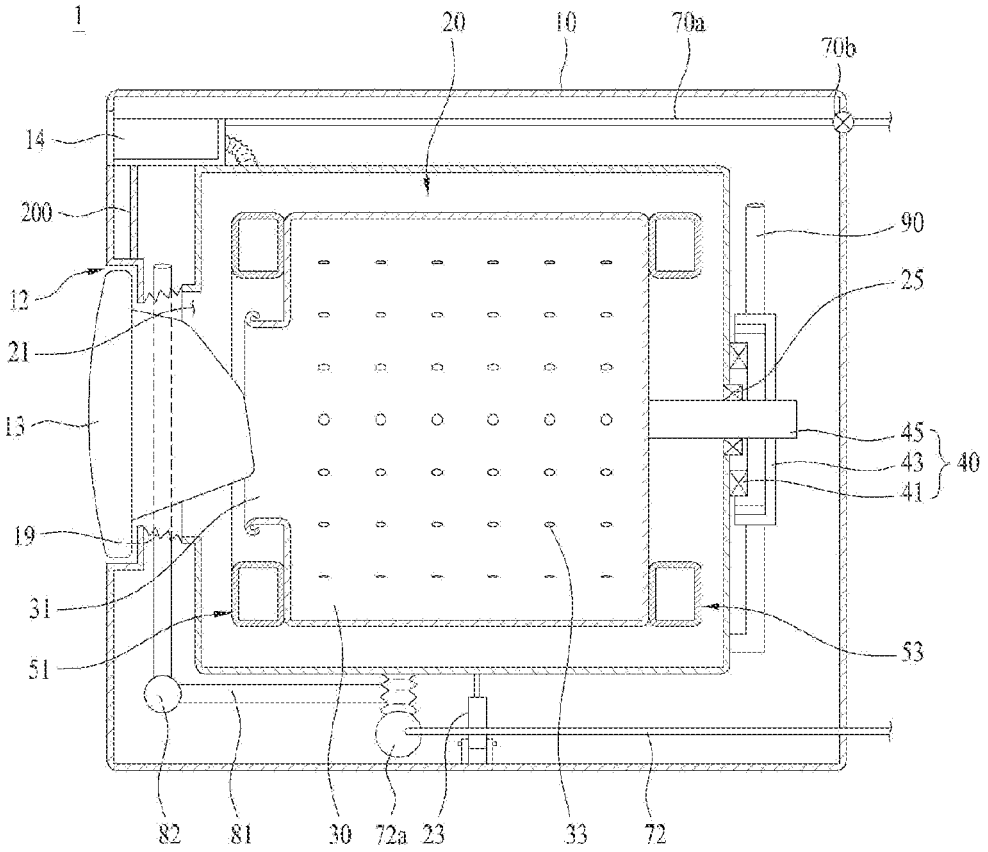
[FIG 1]


Start
Power on
S1
Select course or option
S2
Start
S3
S4
Door is locked?
Detect laundry amount
S5
Display time
S6
Execute
S7
End
(a)
D
L
I
II
(b)

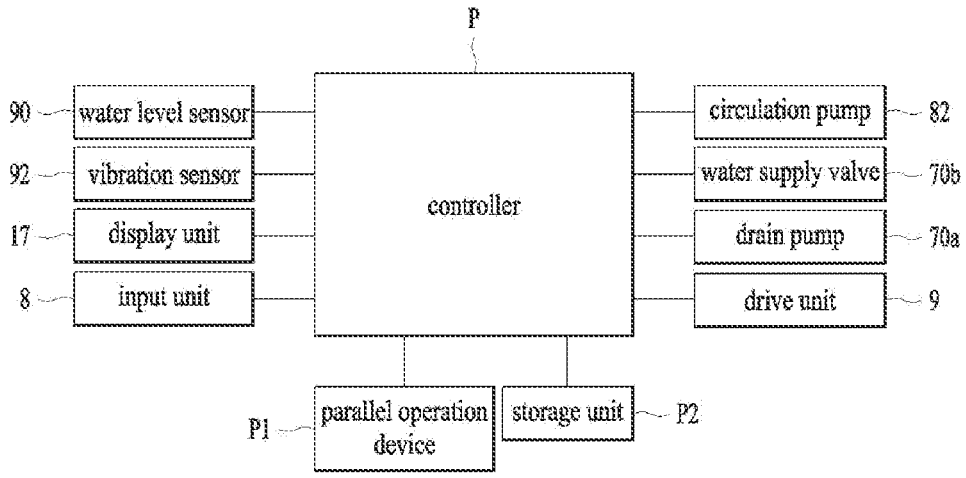
【FIG 2】



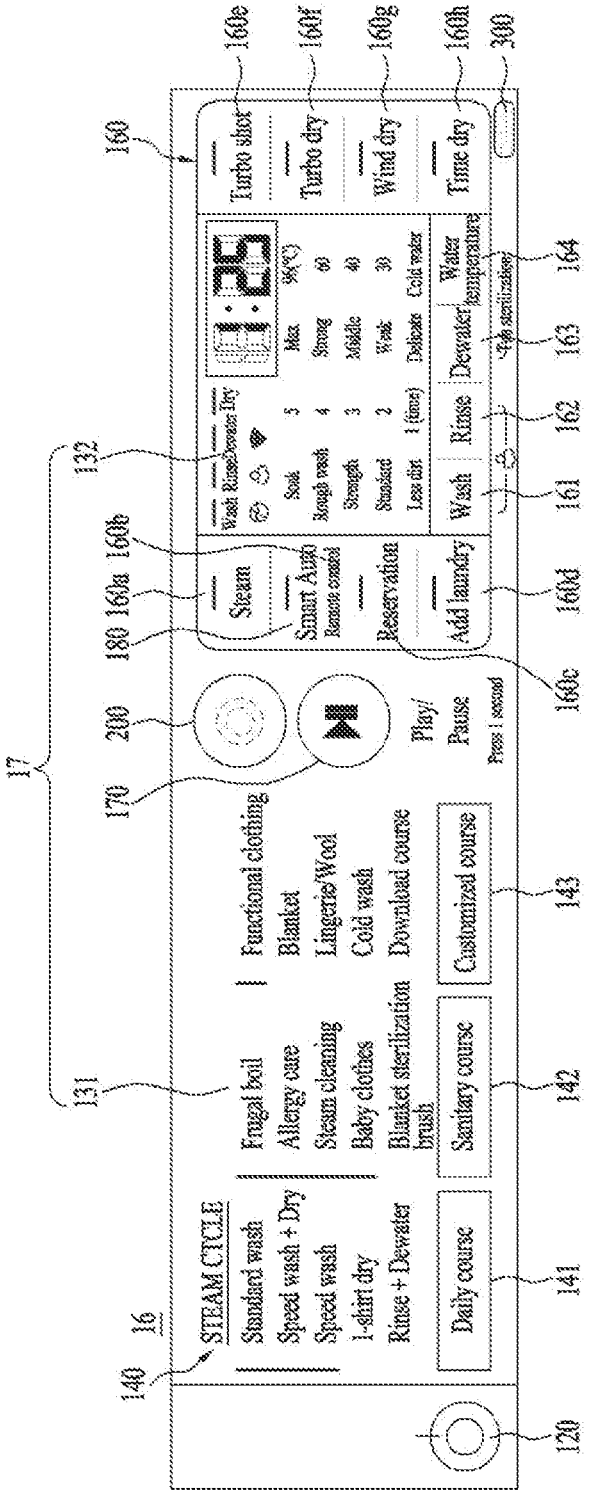
【FIG 3】


1
20
10
70a
70b
14
200
12
21
13
19
31
51
90
25
45
43
41
40
53
82
81
30
72a
23
33
72

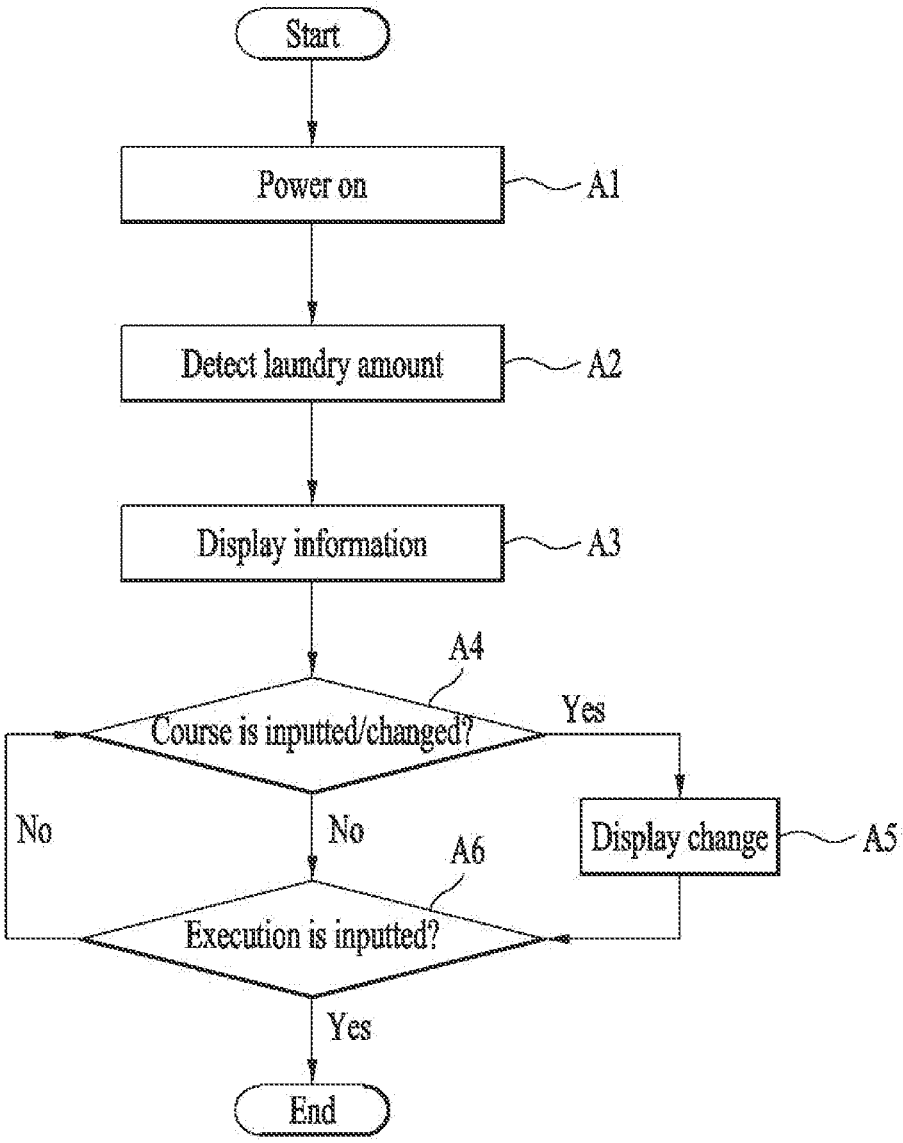
【FIG 4】


P
90
water level sensor
92
vibration sensor
17
display unit
8
input unit
controller
circulation pump
82
water supply valve
70b
drain pump
70a
drive unit
9
P1
parallel operation device
storage unit
P2

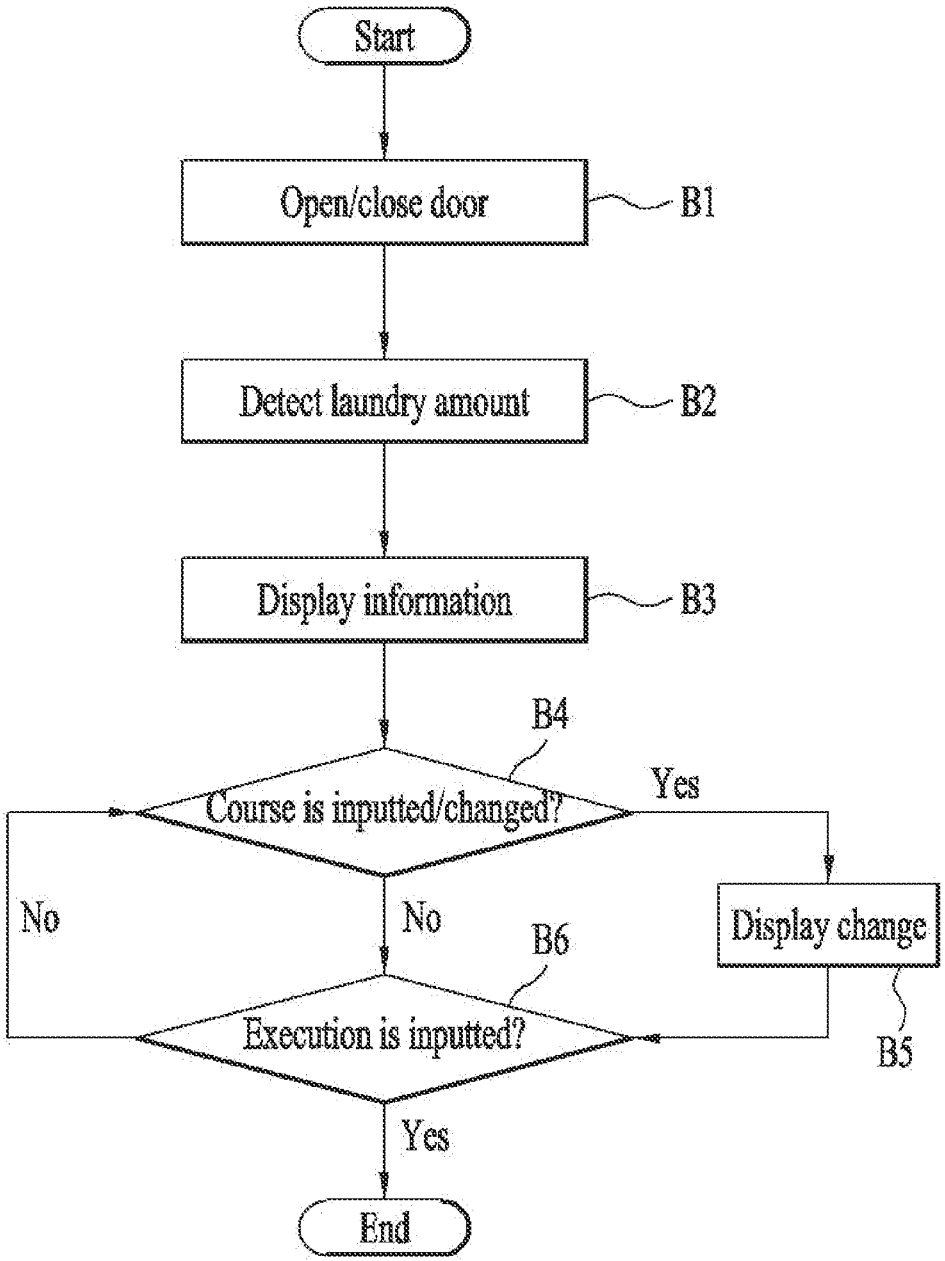
[FIG 5]


160
160e
160f
160g
160h
300
Turbo shot
Turbo dry
Wind dry
Time dry
Steam
Smart Auto
Reservation
Add laundry
Wash
Rinse
Dewater
Water temperature
160b
160a
160c
160d
161
162
163
164
180
132
200
170
17
131
140
16
120
141
142
143
STEAM CYCLE
Standard wash
Speed wash + Dry
Speed wash
1-shirt dry
Rinse + Dewater
Daily course
Frugal boil
Allergy care
Steam cleaning
Baby clothes
Blanket sterilization
Sanitary course
Functional clothing
Blanket
Lingerie/Wool
Cold wash
Download course
Customized course
Play/
Pause
Press 1 second

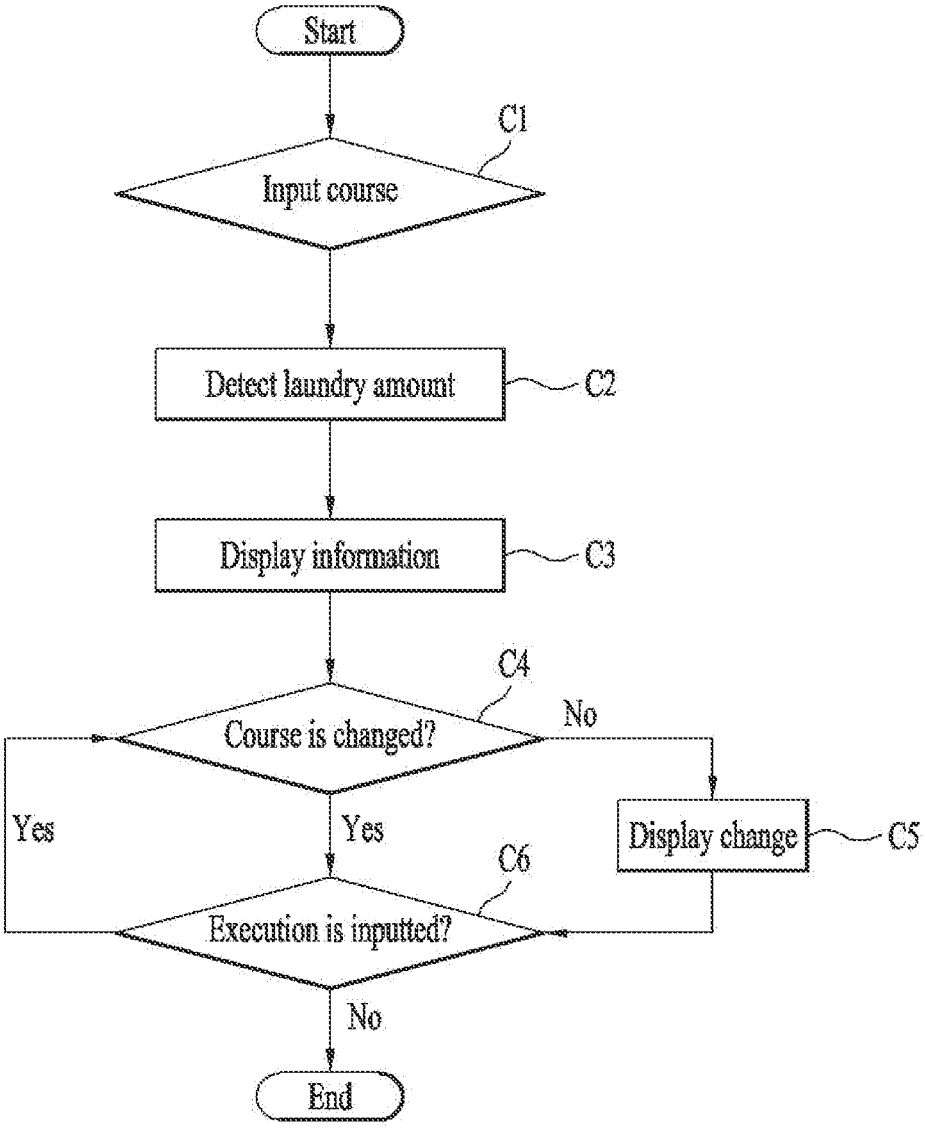
【FIG 6】


Start
Power on
A1
Detect laundry amount
A2
Display information
A3
A4
Course is inputted/changed?
Yes
No
No
Display change
A5
A6
Execution is inputted?
Yes
End

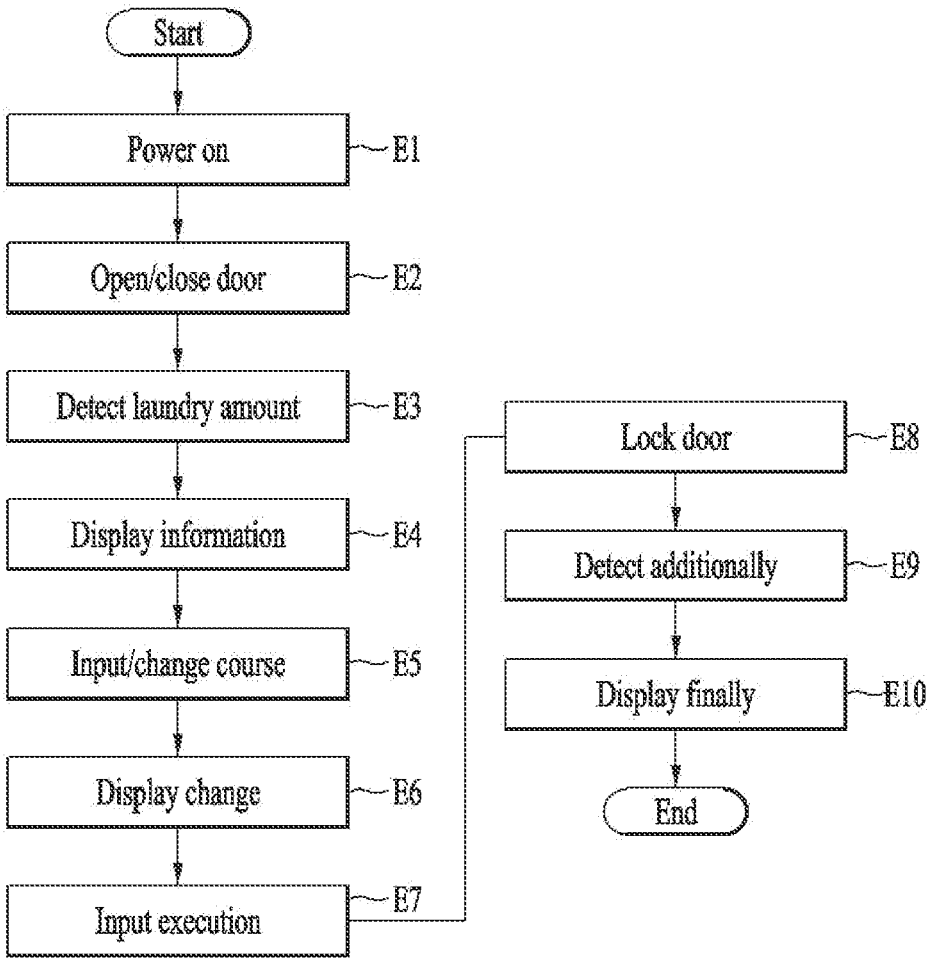
【FIG 7】


Start
Open/close door
B1
Detect laundry amount
B2
Display information
B3
B4
Course is inputted/changed?
Yes
No
No
Display change
B6
Execution is inputted?
B5
Yes
End

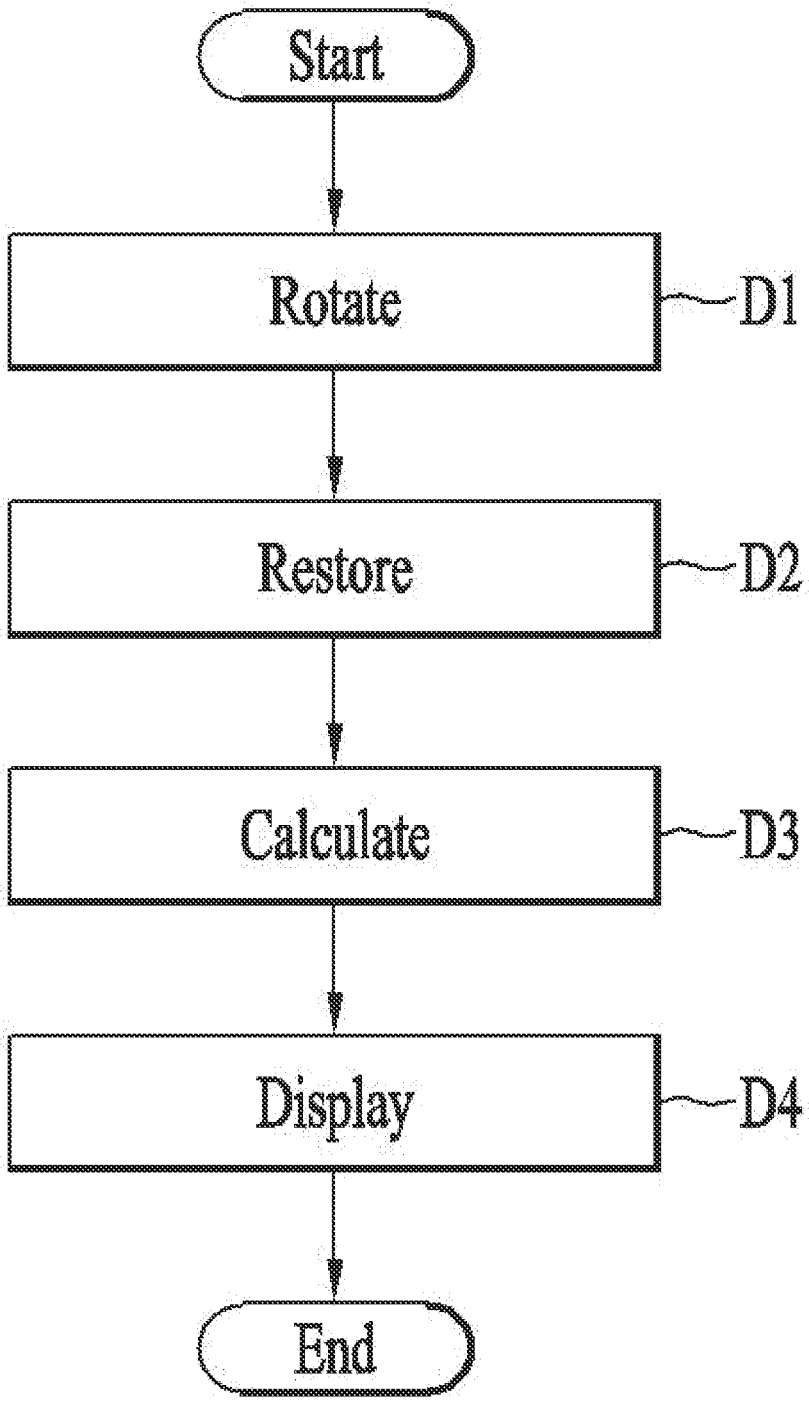
【FIG 8】


Start
C1
Input course
Detect laundry amount
C2
Display information
C3
C4
Course is changed?
No
Yes
Yes
Display change
C5
C6
Execution is inputted?
No
End

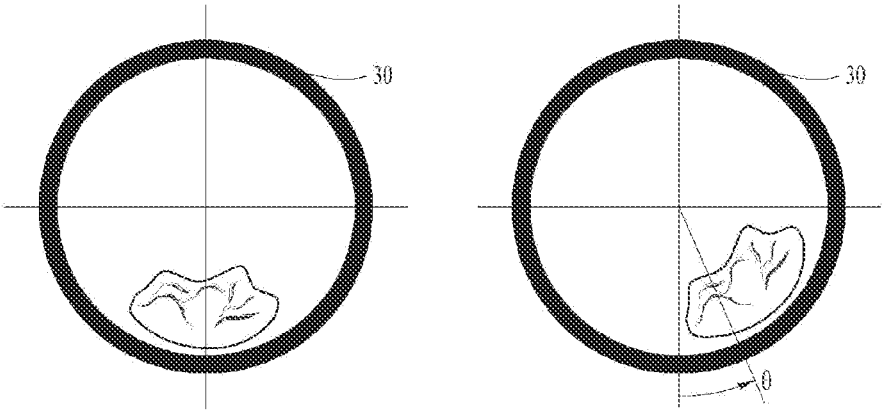
【FIG 9】


Start
Power on
E1
Open/close door
E2
Detect laundry amount
E3
Display information
E4
Input/change course
E5
Display change
E6
Input execution
E7
Lock door
E8
Detect additionally
E9
Display finally
E10
End

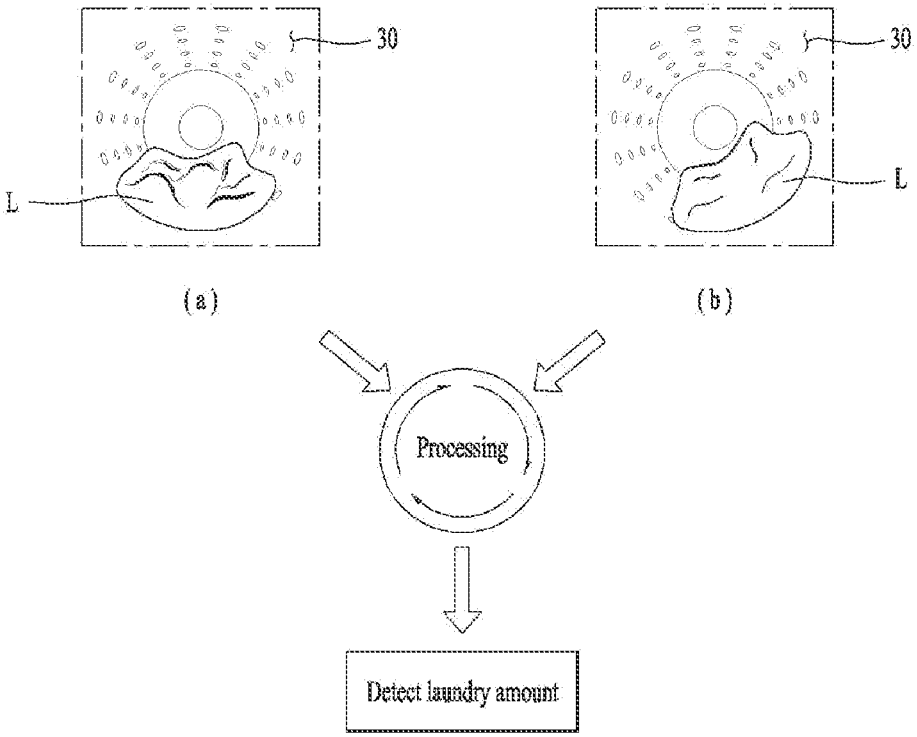
【FIG 10】



【FIG 11】



【FIG 12】



[FIG 13]

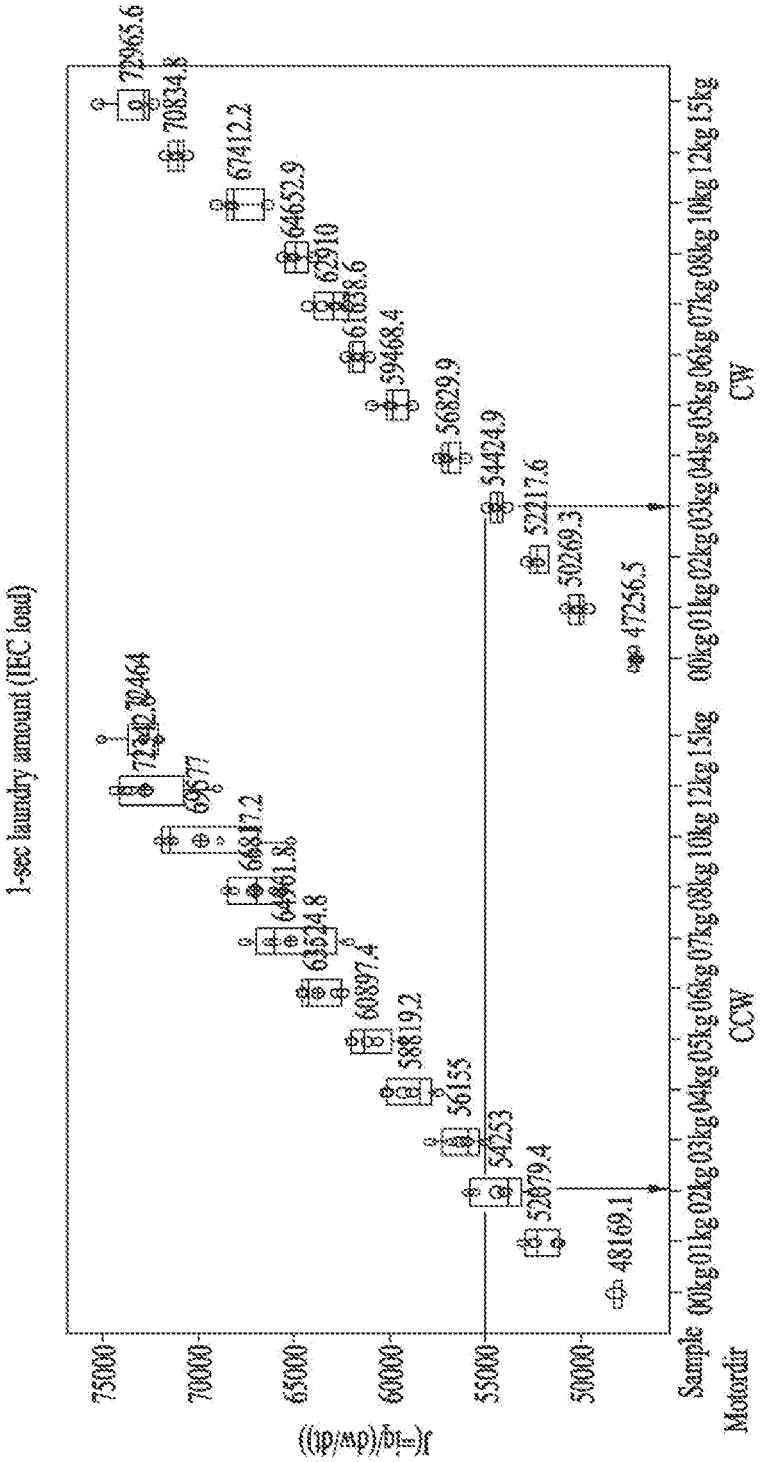
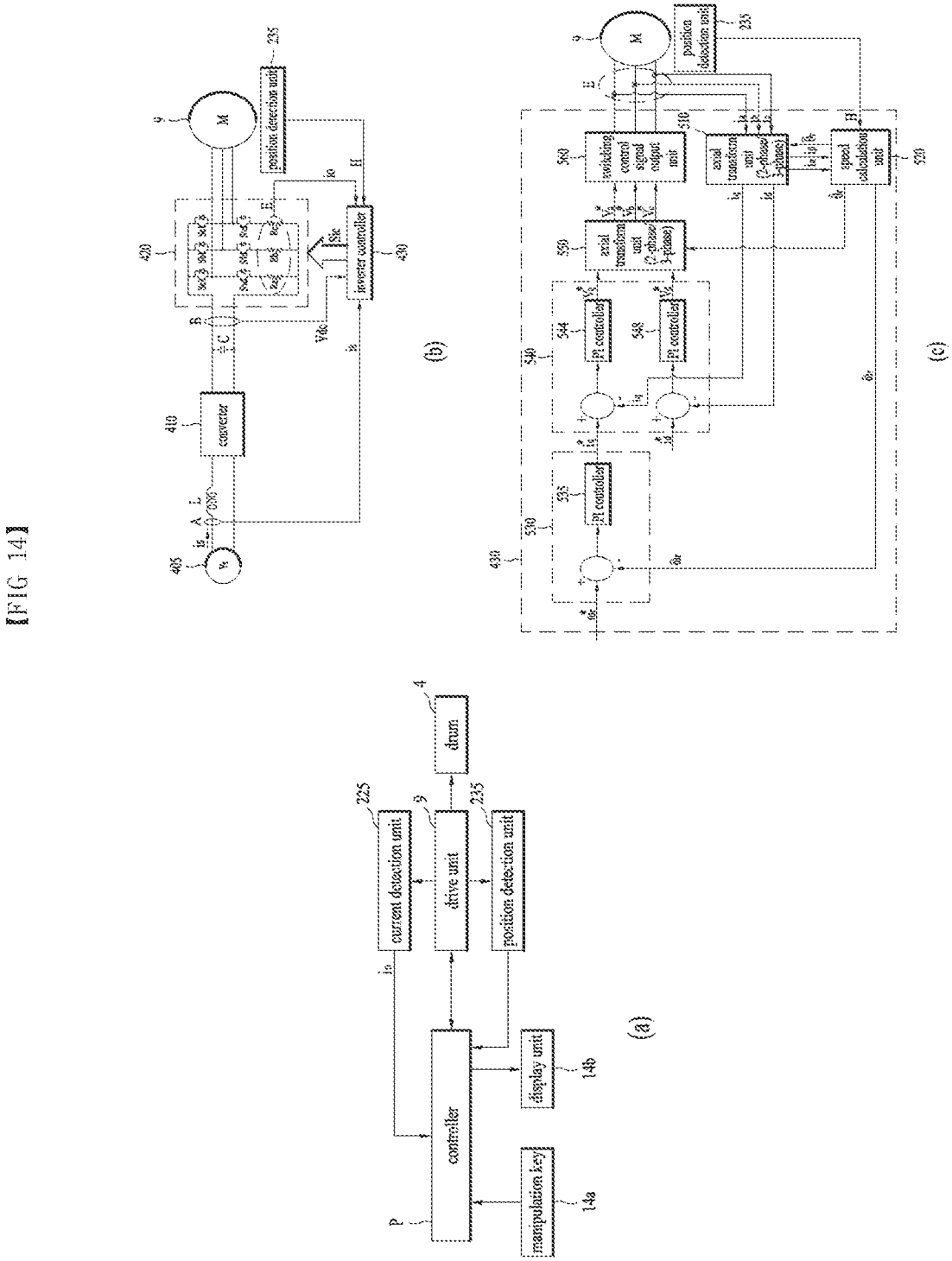
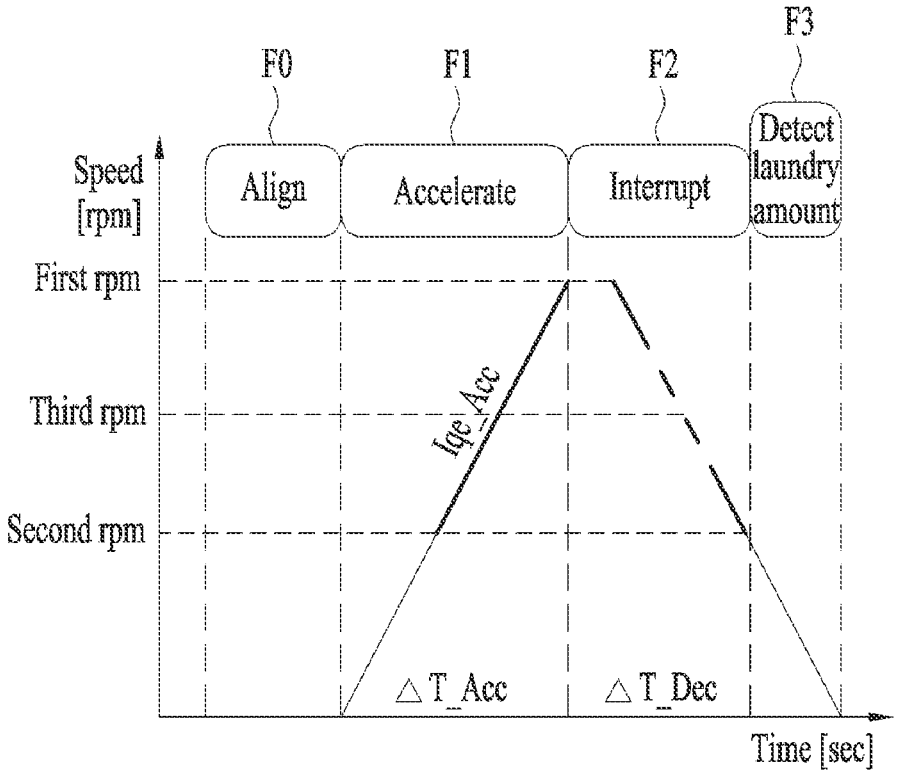

1-sec laundry amount (IEC load)
72965.6
70834.8
67412.2
64652.9
62910
61038.6
59468.4
56829.9
54424.9
52217.6
50269.3
47256.5
72492.2
69677
66817.2
64961.8
63524.8
60897.4
58819.2
56155
54253
52879.4
48169.1
75000
70000
65000
60000
55000
50000
Sample (00kg 01kg 02kg 03kg 04kg 05kg 06kg 07kg 08kg 10kg 12kg 15kg
CCW
00kg 01kg 02kg 03kg 04kg 05kg 06kg 07kg 08kg 10kg 12kg 15kg
CW
Motordir

FIG 14


(a)
drum
current detection unit
drive unit
position detection unit
controller
display unit
manipulation key
14a
14b
(b)
converter
inverter controller
position detection unit
(c)
switching control signal output unit
axial transform unit (2-phase 3-phase)
speed calculation unit
PI controller
PI controller
PI controller

【FIG 15】


F0
F1
F2
F3
Align
Accelerate
Interrupt
Detect laundry amount
Speed [rpm]
First rpm
Third rpm
Second rpm
Iqe_Acc
△T_Acc
△T_Dec
Time [sec]

CLOTHES TREATMENT APPARATUS, AND CONTROL METHOD FOR CLOTHES TREATMENT APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a National Stage Application under 35 U.S.C. § 371 of International Application No. PCT/KR2022/002627, filed on Feb. 23, 2022, which claims priority to Korean Application No. 10-2021-0024377 filed on Feb. 23, 2021. The disclosures of the prior applications are hereby incorporated by reference in their entirety.

TECHNICAL FIELD

[0002] The present disclosure relates to an apparatus for treating laundry and control method thereof.

BACKGROUND ART

[0003] Generally, the term "laundry treating apparatus" refers to a device capable of washing, drying, or washing/drying laundry. Here, the laundry treating apparatus may perform only a washing or drying function, or may perform both washing and drying.

[0004] Such a laundry treating apparatus includes an arbitrary course or option for washing or drying laundry, and an execution time of the course or option is calculated based on the amount of laundry. For example, when the laundry amount is large, the execution time may be set to be relatively long. When the laundry amount is small, the execution time may be set to be relatively small.

[0005] FIG. **1** shows a control method for performing an arbitrary course or option of a laundry treating apparatus of the related art. (Refer to Korean Patent Publication No. 10-2009-0077097, Korean Patent Publication No. 10-2008-0102611, etc.)

[0006] FIG. **1** (*a*) shows a control method of performing an arbitrary course or option by a laundry treating apparatus of the related art.

[0007] Referring to FIG. **1** (*a*), a laundry treating apparatus of the related art may include a power supplying step S**1** of supplying power to the laundry treating apparatus by inputting a power button (on), a selecting step S**2** of selecting an appropriate course or option from a control panel of the laundry treating apparatus, and a starting step S**3** of inputting an execution button for executing the course or option.

[0008] When the laundry treating apparatus of the related art is provided as a front load type washer having an opening provided to a front side of a cabinet to put laundry therethrough, if the starting step S**3** is performed, a door locking step S**4** of fixing the opening to the cabinet may be performed.

[0009] Thereafter, the laundry treating apparatus of the related art performs a laundry amount detecting step S**5** of detecting a laundry amount through a current value applied while a laundry received drum and the like is rotated. Once the laundry amount is calculated, a controller of the laundry treating apparatus of the related art performs a time displaying step S**6** of displaying an estimated execution time of the selected course or option to a user and an executing step S**7** of executing the course or option automatically.

[0010] However, the laundry amount detecting step S**5** and the time displaying step S**6** of the laundry treating apparatus of the related art are performed after the starting step S**3** of executing the course or option by the user. Therefore, there is a problem that the user is forced to input an execution of the course or option while failing to receive information on the laundry amount or the estimated execution time.

[0011] As a result, there are a problem in that the user is unable to control the execution time of the course or option actively and a problem in that the time display step S**6** is unable to play a role above simply displaying only simple information at a service level to the user.

[0012] Furthermore, although the execution time displayed in the time displaying step S**6** fails to fit user's current intention or situation, there is a problem in that the laundry treating apparatus of the related art has no room for the user to take active measures such as adding or reducing laundry.

[0013] In addition, the laundry treating apparatus of the related art has a problem in that the course or option cannot be canceled or changed unless active measures such as arbitrarily turning off the power of the washer are taken to change the selected course or option even if the execution time of the selected course or option does not fit the intention.

[0014] This inconvenience has a problem in being further maximized when remotely controlling the laundry treating apparatus of the related art.

[0015] FIG. **1** (*b*) shows a rotational state of a drum when a laundry treating apparatus of the related art senses a laundry amount.

[0016] Referring to FIG. **1** (*b*), the laundry treating apparatus of the related art rotates the drum D in a direction Ito detect a laundry amount of the laundry L.

[0017] Specifically, the laundry treating apparatus of the related art calculates the weight of the laundry L by measuring a current value applied to or outputted from the drive portion that rotates the drum D while rotating the drum in the direction I.

[0018] When the laundry treating apparatus of the related art rotates the drum D to detect the laundry amount, the laundry L paced on a floor surface of the drum is lifted and then falls in direction II by gravity within the drum D so as to be separated from an inner wall of the drum.

[0019] Accordingly, the laundry treating apparatus of the related art has a limitation in that a current value, which is applied or outputted while continuously rotating the drum D one or more times in the I direction I, should be aligned in order to detect an accurate weight of the laundry L.

[0020] As a result, the laundry treating apparatus of the related art has a problem that the time for sensing the laundry amount inevitably requires more time than the time for continuously rotating the drum.

[0021] In addition, since the time required for the laundry amount detecting step S**5** is set to be relatively long, the laundry treating apparatus of the related art has a problem that the time displaying step S**6** for displaying the execution time of the course or option may not be quickly guided to the user.

[0022] Therefore, the laundry treating apparatus of the related art has a problem that a user is fundamentally blocked from the possibility that a user will utilize information on a laundry amount of laundry or an estimated execution time.

DETAILED DESCRIPTION

Technical Task

[0023] One technical task of the present disclosure is to provide a laundry treating apparatus capable of immediately informing a user of an estimated execution time of a course or option before performing the course or option.

[0024] Another technical task of the present disclosure is to provide a laundry treating apparatus for enabling a user to control an execution time of a course or option that provides a method of performing a washing cycle, a rinsing cycle, and a dewatering cycle within a predetermined range.

[0025] Another technical task of the present disclosure is to provide a laundry treating apparatus for enabling a user to adjust an execution time within an upper or lower limit of an arbitrary course or option.

[0026] Another technical task of the present disclosure is to provide a laundry treating apparatus capable of changing an execution time of one or more of a washing cycle, a rinsing cycle, and a dewatering cycle when a user changes an execution time of an arbitrary course or option.

[0027] Further technical task of the present disclosure is to provide a laundry treating apparatus capable of maintaining a washing effect even if a user changes an execution time of an arbitrary course or option.

[0028] Another further technical task of the present disclosure is to provide a laundry treating apparatus capable of maintaining a dewatering effect even if a user changes an execution time of an arbitrary course or option.

Technical Solutions

[0029] In one technical aspect of the present disclosure, provided is a laundry treating apparatus for detecting a laundry amount while a drum is rotating less than one rotation.

[0030] A laundry amount detecting step of the laundry treating apparatus of the present disclosure may rotate the drum less than one rotation.

[0031] In a rotating step of rotating the drum in the rotating step, the drum may be rotated at an angle or less at which the laundry is separated from an inner wall of the drum or disposition thereof is variable.

[0032] The rotating step may rotate the drum in a range between 0 and 90 degrees. Since variables can be eliminated when the angle gets smaller, the rotating step may rotate the drum in a range between 10 and 45 degrees.

[0033] A calculating step of detecting a laundry amount while performing the rotating step or after completing the rotating step may be performed before a position of the drum is restored.

[0034] The rotating step and the calculating step may be performed all within 0.3 to 1 second.

[0035] The laundry amount detecting step may further include a displaying step of displaying a weight of the laundry on a display portion. The laundry amount detecting step may display an execution time of an arbitrary washing course or option on the display portion.

[0036] The rotating step, the calculating step, and the displaying step may be performed all before a position of the drum is restored.

[0037] The rotating step, the calculating step, and the displaying step may be performed all within 0.3 to 1 second.

[0038] A storage unit storing the laundry weight corresponding to the first current value as data may be further included, and the calculating step may extract the weight of the laundry from the storage unit.

[0039] A restoring step of restoring a position of the drum by cutting of a power applied to the drive portion based on performing the rotating step may be further included, and the calculating step may calculate the weight of the laundry by measuring a second current value outputted from the restoring step.

[0040] A reverse-rotating step of restoring a position of the drum by rotating the drum in reverse may be further included, and the calculating step may calculate the weight of the laundry by measuring a third current value outputted from the reverse-rotating step.

[0041] The laundry amount detecting step may be performed before supplying water to the tub or after draining the water from the tub.

Advantageous Effects

[0042] The present disclosure has an effect of immediately informing a user of an estimated execution time of a course or option before performing the course or option.

[0043] The present disclosure has an effect of enabling a user to control an execution time of a course or option that provides a method of performing a washing cycle, a rinsing cycle, and a dewatering cycle within a predetermined range.

[0044] The present disclosure has an effect of enabling a user to adjust an execution time within an upper or lower limit of an arbitrary course or option.

[0045] The present disclosure has an effect of changing an execution time of one or more of a washing cycle, a rinsing cycle, and a dewatering cycle when a user changes an execution time of an arbitrary course or option.

[0046] The present disclosure has an effect of maintaining a washing effect even if a user changes an execution time of an arbitrary course or option.

[0047] The present disclosure has an effect of maintaining a dewatering effect even if a user changes an execution time of an arbitrary course or option.

[0048] The present disclosure has an effect of detecting a laundry amount before executing a course or option.

[0049] The present disclosure has an effect of detecting a laundry amount before performing locking of a door.

[0050] The present disclosure has an effect that a detergent corresponding to a laundry amount is led to be put before performing locking of a door.

[0051] The present disclosure has an effect that a detergent corresponding to a laundry

[0052] amount is led to be put before executing a course or option.

DESCRIPTION OF DRAWINGS

[0053] FIG. **1** shows a control method of a laundry treating apparatus of the related art.

[0054] FIG. **2** shows an exterior embodiment of a laundry treating apparatus of the present disclosure.

[0055] FIG. **3** shows an embodiment of an inner structure of a laundry treating apparatus of the present disclosure.

[0056] FIG. **4** shows a control configuration of a laundry treating apparatus of the present disclosure.

[0057] FIG. **5** shows an embodiment of a control panel of a laundry treating apparatus of the present disclosure.

[0058] FIG. **6** shows one embodiment of a method of controlling a laundry treating apparatus of the present disclosure.

[0059] FIG. **7** shows another embodiment of a method of controlling a laundry treating apparatus of the present disclosure.

[0060] FIG. **8** shows an additional embodiment of a method of controlling a laundry treating apparatus of the present disclosure.

[0061] FIG. **9** shows an additional method of controlling a laundry treating apparatus of the present disclosure.

[0062] FIG. **10** shows a method of detecting a laundry amount in a laundry treating apparatus of the present disclosure.

[0063] FIG. **11** shows a drum rotation angle upon laundry amount detection in a laundry treating apparatus of the present disclosure.

[0064] FIG. **12** shows a detailed process of laundry amount detection in a laundry treating apparatus of the present disclosure.

[0065] FIG. **13** shows an embodiment of detecting a laundry amount with inertia moment only in a laundry treating apparatus of the present disclosure.

[0066] FIG. **14** shows an aspect of detecting a current by a drive portion **9** in a laundry treating apparatus of the present disclosure.

[0067] FIG. **15** shows an additional embodiment of detecting a laundry amount in a laundry treating apparatus of the present disclosure.

BEST MODE

[0068] Reference will now be made in detail to the preferred embodiments of the present disclosure, examples of which are illustrated in the accompanying drawings. In this specification, the same or similar reference numbers shall be assigned to the same or similar configurations even in different embodiments, and the description thereof shall be replaced with the first description. The singular representations used in this specification include plural representations unless explicitly meant otherwise in the context. In explaining embodiments of the present disclosure, if it is deemed that a specific description of the prior art related to the present disclosure may unnecessarily blur the gist of the present disclosure, the detailed description shall be omitted. It should also be noted that the accompanying drawings are intended to facilitate understanding of the embodiments disclosed in this specification and should not be construed as limiting the technical ideas disclosed in this specification by the accompanying drawings.

[0069] FIG. **2** shows an embodiment of a laundry treating apparatus of the present disclosure. FIG. **3** shows an inner structure of a laundry treating apparatus of the present disclosure.

[0070] In the orthogonal coordinate system shown in the drawing, positive and negative directions of the x-axis are defined as front and rear directions of a laundry treating apparatus, respectively, and positive and negative directions of the z-axis are defined as top and bottom directions of the laundry treating apparatus. In addition, a positive direction of the y-axis is defined as a right direction of the laundry treating apparatus, and a negative direction of the y-axis is defined as a left direction of the laundry treating apparatus.

[0071] Referring to FIG. **2**, a laundry treating apparatus **1** of the present disclosure may include a cabinet **10** forming an exterior and a laundry receiving part **20'** provided within the cabinet **10** to receive laundry therein.

[0072] The cabinet **10** forms the exterior of the laundry treating apparatus **1** and may include an opening **12** through which laundry may be put or withdrawn and a door **13** opening/closing the opening **12**. The door **13** is rotatably coupled to a front side of the cabinet **10**, and the opening **12** may be opened/closed depending on turning the door **13**.

[0073] Meanwhile, FIG. **2** exemplarily illustrates a laundry treating apparatus of a front load type, in which the opening **12** and the door **13** are formed on the front side of the cabinet **10**. Alternatively, the present disclosure may include a laundry treating apparatus of a top load type, in which the opening **12** and the door **13** are formed on a top side of the cabinet **10**.

[0074] When the door **13** is coupled to the opening **12**, it is locked so as not to open the opening **12** arbitrarily.

[0075] The door **13** or the cabinet **10** may include a lock part configured to fix the door **13** to the cabinet **10**.

[0076] The lock part includes a solenoid, a direct fastening means or the like and may be configured to enable the door **13** to lock the opening **12**. A detergent box **14** detachably received in the cabinet to receive a detergent or fabric softener therein and a control panel **16** configured to input an activation command to the laundry treating apparatus or display a status of the laundry treating apparatus may be provided to the front side of the cabinet **10**.

[0077] The detergent box **14** and the control panel **16** may be disposed above the opening **12** to be easily gripped or touched by a user.

[0078] The detergent box **14** is configured to be withdrawable in a front direction and may store a powder or liquid detergent therein. For example, the detergent box **14** may be a drawer type.

[0079] The control panel **16** may be provided to one side of the detergent box **14**, and may include an input unit **18** to receive an input of an activation command including a washing course and option information related to washing from a user and a display portion **17** to display the inputted information and a washing progress status.

[0080] The input unit **18** may be a button type or a rotary knob type and may be provided as a touch panel. The display portion **17** may include a display portion having liquid crystals and a speaker outputting sound. Yet, the display portion **17** may be configured in any shape capable of displaying the status of the laundry treating apparatus **1**, and may be integrally provided with the input unit **18**.

[0081] In some implementations, the control panel **16** may be provided with a controller P to control the laundry treating apparatus **1**.

[0082] The controller may control the electronic parts of the laundry treating apparatus **1** described later by being supplied with power from an external power source.

[0083] In this case, since the electronic parts (hereinafter, a load unit) are connected in parallel to the controller, each load unit (e.g., a drive portion, a water supply valve, a communication module, etc.) may operate independently.

[0084] The laundry receiving part **20'** provided in a manner of being received in the cabinet **10** may include a tub **20** storing water therein and a drum **30** rotatably received in the tub **20** to receive laundry therein.

[0085] Referring to FIG. **3**, the tub **20** is provided within the cabinet **10**, and may for a space for storing wash water therein. For example, the tub may have a cylindrical shape.

[0086] The tub **20** may include a tub entrance **21** through which laundry is put or withdrawn and a tub support part **23** fixing the tub **20** to an inside of the cabinet **10**. The tub entrance **21** may communicate with the entrance **12**. The tub support part **23** is provided under the tub **20** and may attenuate the vibration generated from the tub **20**. For example, the tub support part may include a damper, a spring, etc.

[0087] The tub **20** may further include a water level sensor **90** measuring a water level in the tub. The water level sensor **90** may include an extension pipe extended from a bottom end of the tube to an upper side, a diaphragm provided to seal a top end of the extension pipe, and a sensor detecting a frequency of the diaphragm.

[0088] The laundry treating apparatus **1** of the present disclosure may further include a vibration sensor **92** detecting vibrations within the tub **20**. The vibrations sensor **92** is configured to detect at least one of the vibrations on x-, y- and z-axes and may deliver a state of an inside of the tub to the controller.

[0089] The drum **30** is rotatably provided within the tub **20**, and may include a drum entrance **31** through which laundry may be put or withdrawn. For example, the drum may have a cylindrical shape. The drum entrance **31** may communicate with the entrance **12** and the tub entrance **21**. Therefore, laundry may be put into the drum **30** through the entrance **12**, the tub entrance **21** and the drum entrance **31** in order.

[0090] Meanwhile, between the entrance **12** of the cabinet **10** and the tub entrance **21** of the tub **20**, a gasket **19** may be further provided. The gasket **19** prevents the wash water in the tub **20** from leaking to the cabinet **10** and may also prevent the vibration generated from the tub **20** from being delivered to the cabinet **10**. For example, the gasket may include an elastic member.

[0091] A plurality of perforated holes **33** communicating with the tub **20** may be formed in an inner circumferential surface of the drum **30**. The wash water received in the tub **20** may be supplied into the drum **30** through the perforated holes **33**, and the wash water in the drum **30** may be discharged to the tub **20** through the perforated holes **33**.

[0092] In some implementations, the laundry treating apparatus **1** of the present disclosure may include a drive portion coupled to the tub **20** to rotate the drum **30**, a water supply unit **70** supplying wash water into the tub **20**, and a drain unit **80** discharging the wash water of the tub **20** externally.

[0093] The drain unit **80** may include a drain pipe **81** communicating with the tub **20**, and may further include a drain pump **82** connected to the drain pipe to provide a power for draining water to the tub **20**.

[0094] The water supply unit **70** may include a water supply pipe **71** supplying water to the tub **20** and a water supply valve opening/closing the water supply pipe **71**, and the water supply pipe **71** may be configured to communicate with the detergent box **14**.

[0095] Therefore, the detergent box **14** is configured to communicate, thereby supplying a detergent to the tub **20** automatically for water supply.

[0096] In some implementations, the laundry treating apparatus **1** of the present disclosure may further include a circulation unit **80***a* circulating again the water drained from the tub **20**. The circulation unit **80***a* may include a circulation flow path **81***a* having both ends connected to the tub **20** and a circulation pump **82***b* providing a power to the circulation flow path.

[0097] The circulation pump **82***b* communicates with a bottom surface of the tub **20** to pressurize the wash water, and the circulation flow path **81***a* may be configured to spray the wash water into the drum in a manner that one side of the circulation flow path **81***a* is connected to the circulation pump while the other side is connected to the gasket **19**.

[0098] Yet, since the circulation flow path and the circulation pump described above are the components necessary for a case of spraying the wash water stored in the tub, it may not exclude a case of spraying the wash water into the drum through a spray water supply flow path connected to a water supply source outside the cabinet.

[0099] Namely, when one side of the spray water supply flow path is connected to the water supply source and the other side is connected to the tub, if a nozzle capable of spraying wash water into the drum is provided, the wash water may be sprayed into the drum during a filtration motion and a squeeze motion.

[0100] In addition, the laundry treating apparatus **1** of the present disclosure may further include balancers **51** and **53** to attenuate the vibration generated from the drum **30**. The balancers **51** and **53** may remove the eccentricity of the drum **30**, which is generated as laundry is unequally distributed within the drum **30**. Namely, the balancers **51** and **53** are moved to specific positions under the control of the microcomputer, thereby attenuating the unbalance of the drum **30**.

[0101] In this case, the balancer may be provided to each of front and rear sides of the drum **30** or may be provided to either the front side or the rear side of the drum **30**. For example, the balancer may include a front balancer **51** and a rear balancer **53** provided to the front side and the rear side of the drum **30**, respectively. The balancers may include ball balancers, liquid balancers, etc.

[0102] The drive portion **9** is provided to an outside of the tub **20**, and may be connected to the drum **30** in a manner of being coupled to or penetrating a backside of the drub **20**. The drive portion **9** is fixed to the backside of the tub **20**, and may convert electric energy into mechanical energy. Namely, the drive portion **9** may rotate the drum **30** by being supplied with a current externally.

[0103] The drive portion **9** may include a stator **91** generating a magnetic field, a rotor **93** rotated by the magnetic field within the stator **91**, and a rotation shaft connecting the drum **30** and the rotor **93** together by penetrating the backside of the tub **20**.

[0104] The drive portion may include a Bush-Less Direct Current (BLDC) motor. IN this case, the stator **41** may include a coil and the rotor **93** may include a permanent magnet. Meanwhile, a rotation shaft bearing **25** rotatably supporting the rotation shaft **95** may be further provided to the backside of the tub **20**.

[0105] FIG. **4** shows the configuration of the controller controlling the load of the present disclosure.

[0106] The controller P is provided to a control panel and the like and may be configured to perform a washing course and an option by receiving an input of a command for activating the laundry treating apparatus through the input unit **16**. Namely, the controller P may be configured to control the water supply valve **72**, the drain pump **82** and the

drive portion **9** using water level information detected by the water level sensor **90** while performing the determined washing course and option.

[0107] In addition, the controller P may provide a current status of the laundry treating apparatus through the display portion **17**, and may be provided to detect the vibration of the drum through a vibration sensor **92** or a current value applied to the drive portion **9**.

[0108] In some implementations, the controller P may further include a parallel operation device P**1** capable of receiving and processing a signal value of the vibration sensor **92**, a current value applied to the drive portion **40**, an RPM of the drum **30**, etc.

[0109] In addition, the controller P may further include a storage unit P**2** capable of storing a data value processed by the parallel operation device, an algorithm for operating the parallel operation device P**1**, and various electric signals inputted to the parallel operation device P**1**.

[0110] The controller P of the present disclosure may implement an artificial neural network learning logic for generating an artificial neural network with the parallel operation device P**1** and the storage unit P**2**. The artificial neural network may be used to derive one coherent result value by combining and analyzing a plurality of factors.

[0111] A controller of the related art has a problem that a single output value may be derived using a single input value only. Yet, since the laundry treating apparatus of the present disclosure may utilize two or more signals through the laundry treating apparatus of the present disclosure, it may obtain necessary information more accurately than using a single information.

[0112] In some implementations, a plurality of courses or options for operating the laundry treating apparatus may be pre-stored in the storage unit P**2**. A plurality of the courses or options may include a combination of a method or sequence for operating the water supply valve **72**, the drive portion **9** and the drain pump **82** and an operating strength thereof to perform a washing cycle, a rinsing cycle, and a dewatering cycle.

[0113] In the storage unit P**2**, data of matching a current value applied to or outputted from the drive portion **9** to a laundry amount, a laundry texture or the like may be stored as a table and the like.

[0114] In the storage unit P**2**, an estimated time of a plurality of the courses or options corresponding to the amount of laundry may be stored as data.

[0115] In addition, an appropriate detergent amount necessary to perform each course or option corresponding to an amount of laundry may be pre-stored as data. The detergent amount may conceptually include one or more of a wash detergent, a softener, and a bleach.

[0116] The controller P may control each of the components of the laundry treating apparatus using various algorithms and data stored in the storage unit P**2**.

[0117] If the amount of the laundry is detected, the controller P may calculate one or more of an execution time and a necessary detergent amount for an arbitrary course or option for performing a washing of the laundry.

[0118] FIG. **5** shows one embodiment of the control panel **16** provided to the laundry treating apparatus **1** of the present disclosure.

[0119] The display portion **17** may be provided as a display panel only, but the input unit **18** may be provided as a physical button that is inputtable separately.

[0120] The control panel **16** may include a power unit **120** receiving an input of a command for supplying a power to the laundry treating apparatus **1**.

[0121] If the power unit **120** is inputted, a power may be supplied to the control panel **16**, and the controller P including the drive portion **9** may be supplied with the power all.

[0122] The input unit **18** may further include a selection unit for selecting or changing the washing course or option. The selection unit **140** and **160** may include a course selection unit **140** configured to receive an input of selecting one of arbitrary courses of performing a series of washing processes including washing, rinsing and dewatering cycles of the laundry treating apparatus **1** and an option selection unit **160** configured to receive an input of selecting one of arbitrary options for adjusting strength and level of the course.

[0123] For example, when the laundry treating apparatus **1** is provided as a washer, the course may be classified into a first course including washing methods of removing foreign substances of general laundry or a set thereof, a second course including washing methods of sterilizing the laundry or a set thereof, and a third course including methods of removing foreign substances in consideration of texture of the laundry and a set thereof.

[0124] In addition, the option may be classified into a first option of adjusting a washing strength in the selected course, a second option of adjusting the number of rinsing, a third option of adjusting a dewatering strength, and a fourth option of determining a water temperature of a tub receiving laundry and water therein. Adjusting the washing strength and the dewatering strength may mean adjusting an rpm of the drum, a rotation direction change cycle of the drum and the like in the washing cycle and the dewatering cycle.

[0125] As the first course is the classification of a general course of washing laundry, it may be referred to as a daily course. As the second course is the classification of a course for sterilization, it may be referred to as a sanitary course. As the third course is the classification of a course in consideration of laundry texture, laundry amount and the like, it may be referred to as a customized course.

[0126] The course selection unit **140** may be configured to select a course set or selected sequentially if inputted repeatedly.

[0127] The course selection unit **140** may include a first course selection unit **141** configured to select one from the first course, a second course selection unit **142** configured to select one from the second course, and a third course selection unit **143** configured to select on from the third course.

[0128] The option selection unit **160** may be configured to select a course set or displayed sequentially by being repeatedly inputted like the course selection unit **140**. In addition, the option selection unit **160** may include a first option selection unit **161** adjusting a washing strength in the selected course, a second option selection unit **162** adjusting the number of rinsing, a third option selection unit **163** adjusting a dewatering strength, and a fourth option selection unit **164** adjusting a water temperature of the tub receiving laundry and water therein. The option selection unit **160** may be configured to select a desired option by inputting each option selection unit sequentially.

[0129] The display portion **130** may include a liquid crystal display, and may include a light-reflecting lamp, a

sound-emitting speaker, etc. The display portion **130** may include a first display portion **131** displaying a course selected from the course selection portion **140** and a second display portion **132** displaying an option selected from the option selection unit **160**.

[0130] The first display portion **131** may be configured to display the selected course. For example, a portion corresponding to the selected course may be turned on or a name of the course may be represented on the display portion.

[0131] The second display portion **132** may be configured to display the selected option. For example, a portion corresponding to the selected option may be turned on or a name of the option may be represented on the display portion.

[0132] Specifically, the first display portion **131** may be configured in a manner of if the course selection unit **140** is inputted, turning on a corresponding course, or in a manner of if the course selection unit **140** is inputted, displaying a corresponding course on an LCD or emitting sound. The first display portion **131** may include a display panel or a lamp that emits light next to a text that describes the course contents.

[0133] If a user clicks the daily course **141**, the general course is sequentially turned on in order so as to have a corresponding course recognized by the user.

[0134] If a user clicks the sanitary course, a course sequentially corresponding to the sanitary course is turned on in order. If a user clicks the customized course, a course sequentially corresponding to the customized course may be turned on in order.

[0135] The second display portion **132** may be configured in a manner of if the option selection unit **160** is inputted, turning on a corresponding option, or in a manner of if the option selection unit **160** is inputted, displaying a corresponding option on an LCD or emitting sound. The second display portion **132** may include a display panel or a lamp that emits light next to a text that describes the option contents.

[0136] As the option selection unit **160** is repeatedly clicked or touched, the first to fourth options may be turned on sequentially. Thus, a user may select a desired option.

[0137] In some implementations, the option selection unit **160** may further include a switch or a touch zone capable of performing an additional function on the laundry treating apparatus las well as the Wash, Rinse, Dewater, and Water temperature.

[0138] The option selection unit **160** may further include a steam adjustment unit **160***a* adding an option of supplying steam into the laundry treating apparatus **1**, a reservation unit **160***b* of pre-determining an operation time of the laundry treating apparatus **1**, an additional setting unit **160***d* clicked to add laundry during an operation of the laundry treating apparatus **1**, a turbo unit **160***e* forming a strong water current by instantly raising a drum rpm of the laundry treating apparatus **1**, a turbo dry unit **160***f* adding an option of supplying strong hot air, a wind dry unit **160***g* adding an option of supplying warm or cool air other than hot air, and a time dry unit **160***h* adding an option of performing natural drying by rotating only a drum at a predetermined speed.

[0139] In some implementations, the second display portion **132** may include a display portion capable of displaying status information of the laundry treating apparatus **1** except a process for inputting a course or option in case that a drying or washing cycle is in progress, that a reservation setting is performed, or that a drying or washing cycle ends, despite displaying details of an option of a course at the moment of determining the course or option.

[0140] The display portion **17** may further include a third display portion **133** displaying an execution time estimated when a plurality of the courses or options are performed.

[0141] If a prescribed course or option is selected from a plurality of the courses or options, the third display portion **133** may display an execution time of the course or option according to an amount of the laundry to a user.

[0142] In addition, the above-described structure is only an embodiment, and the control panel **16** may be provided in any form as long as it may include the input unit **18** receiving an input of a command to drive the laundry treating apparatus and the display portion **17** displaying the status of the laundry treating apparatus.

[0143] A user may set a desired course or option by inputting the course selection unit **140** or the option selection unit **160**. In addition, even if the user does not input the course selection unit **140** or the option selection unit **160**, a standard course or a standard option may be preset.

[0144] For example, reference values of the standard washing course and Wash/Rinse/Dewater/Water temperature may be determined as standards.

[0145] A user may select a desired course or option by inputting the course selection unit **140** and the option selection unit **160**, and may desire to perform a standard course or option set as a reference as it is. For the course of option, the user may select a prescribed course of option by inputting the course selection unit **140** and the option selection unit **160**, or may select the standard course or option by not inputting the course selection unit **140** and the option selection unit **160**.

[0146] The control panel **16** may include an execution unit **170** receiving an input of a command to execute the selected course or option or the preset standard course or option.

[0147] If the execution unit **170** is inputted, the controller P may lock the door **13** not to be separated from the cabinet **10**. A detection unit detecting whether the door **13** is located to the cabinet **10** may be installed in at least one of the door **13** and the cabinet **10**, and the detection unit may be controlled by the controller P.

[0148] An execution time of a standard course or option or a course or option selected by a user may be displayed on the third display portion **133**.

[0149] In some implementations, the display portion **16** may be configured to indicate detergent amounts necessary to perform a plurality of the courses or options. The execution time of the course or option may vary depending on an amount of laundry. In addition, the detergent amount to perform a plurality of the courses or options may vary depending on the amount of the laundry.

[0150] Therefore, if detecting the amount of the laundry, the controller P may display at least one of the execution time of the course or option and the detergent amount necessary for the course or option on the display portion **17**.

[0151] For example, an estimated execution time of the course or option may be displayed on the third display portion **133** and a necessary detergent amount may be displayed on the second display portion **132**.

[0152] The laundry treating apparatus of the present disclosure may first detect an amount of the laundry before inputting the execution unit **170** and then display the esti-

mated time of the selected course or option and the necessary detergent amount on the display portion **16**.

[0153] To this end, the controller P of the laundry treating apparatus of the present disclosure may be configured to detect the amount of the laundry before the execution unit **170** is inputted.

[0154] The controller P may calculate the amount of the laundry through a current value applied to or outputted from the drive portion **9** over controlling the drive portion **9**, and may display an estimated execution time of the selected course or option to a user even before inputting the execution unit **170**.

[0155] Thus, the user may be immediately informed on the estimated execution time of the course or option before the selected course or option is executed. If the estimated execution time fails to fir a situation or a user's schedule, the user may be guided to select other courses or options.

[0156] Thus, the user may immediately change the course or option initially selected by the user into a course or option appropriate for a situation of the user.

[0157] In addition, a user may change a course or option while checking estimated execution times of several courses or options in advance before executing a selected course or option.

[0158] In addition, a user may check a necessary detergent amount appropriate for laundry in a current status of a course or option selected from a plurality of courses or options and then put an appropriate amount of detergent.

[0159] In some implementations, the control panel **16** of the laundry treating apparatus of the present disclosure may further include a time adjustment unit **200** capable of changing an execution time of the executed course or option.

[0160] The time adjustment unit **200** may be configured in a manner of selecting the course or option and then inputting some buttons of the option selection unit **160**, or may be provided as a separate button in the control panel **16**.

[0161] For example, when the time adjustment unit **200** is provided as a separate button, a user may input the time adjustment unit **200** and then extend or reduce an estimated execution time of the selected course or option.

[0162] The extension or reduction of the estimated execution time may be performed by inputting some buttons of the option selection unit **160**.

[0163] For example, an execution time may be adjusted by inputting the option button of Dewater **163** and the option button of Water temperature **164**.

[0164] FIG. **6** shows one embodiment of a control method of detecting an amount of laundry before inputting the execution unit **170**.

[0165] If the power unit **120** of the laundry treating apparatus of the present disclosure is inputted, the water supply unit **70**, the drive portion **9**, the drain unit **80** and the like may be provided with power and the controller P may be provided with power as well.

[0166] As the power unit **120** is inputted, if the controller P is supplied with power, the controller P may be configured to detect at least one of the laundry amount and the laundry texture.

[0167] In the laundry treating apparatus of the present disclosure, a prerequisite condition for detecting at least one of the laundry amount and the laundry texture may include an input of the power unit **120**.

[0168] Therefore, before a user inputs the power unit **120**, even if the user opens the door **13**, puts laundry into the drum **30**, and then closes the door **13**, the controller P may immediately detect the amount of the laundry.

[0169] The controller P may calculate an estimated time for executing a specific course or option according to the laundry amount.

[0170] To this end, the controller P may recognize in a manner of matching the estimated time corresponding to the laundry amount in the storage unit P**2**.

[0171] In addition, a detergent amount necessary for the laundry amount to execute an arbitrary course or option may be organized as data. The controller P may calculate a detergent amount necessary to perform washing on the laundry according to the course or option in the storage unit P**2**.

[0172] For example, the laundry treating apparatus of the present disclosure may perform a power supplying step A**1** of supplying a power by inputting the power unit **120** of the laundry treating apparatus and a laundry amount detecting step A**2** of detecting an amount of laundry received in the drum **30** based on performing the power supplying step A**1**.

[0173] The laundry amount detecting step A**2** may detect a texture of the laundry. Thus, as the laundry amount detecting step may detect one or more of a laundry weight and a laundry texture, it may be regarded as a laundry state detecting step.

[0174] The texture of the laundry may be calculated if one or more of a moisture content, a laundry volume and a laundry amount are inputted to the controller.

[0175] Hereinafter, detection of an amount of laundry will be mainly described, but detection of a texture of the laundry is not excluded.

[0176] If the amount of the laundry is detected in the laundry amount detecting step A**2**, an information displaying step A**3** of displaying at least one of the amount of the laundry, an estimated execution time of a course or option of performing washing of the laundry, and a detergent amount necessary for the course or option on the display portion **16** may be performed.

[0177] In the information displaying step A**3**, an execution time corresponding to a preset standard course or option matched to the amount of the laundry may be displayed.

[0178] A user may check the laundry amount and the execution time of the preset course or option, which are displayed in the information displaying step A**3**, and then compare them with a schedule of the user, and may check a detergent amount.

[0179] If the user is satisfied with the information displayed in the information displaying step A**3**, the user may input the execution unit **170**. The controller P may perform an execution inputting step A**6** of detecting that the execution unit **170** is inputted.

[0180] Once the execution inputting step A**6** is performed, the controller P locks the door **13** to the cabinet **10** by controlling the lock unit, thereby preventing the door **13** from being open arbitrarily.

[0181] In addition, if the execution inputting step A**6** is performed, the controller P may perform one or more of a washing cycle, a rinsing cycle and a dewatering cycle according to the settings of the course or option. After the execution inputting step A**6**, a procedure for detecting an amount of laundry may be skipped. Therefore, a total washing time may be prevented from being delayed.

[0182] In some implementations, after the user has confirmed at least one of the amount of the laundry, the

execution time of the preset course or option, and the detergent amount in the information displaying step A**3**, a course setting step A**4** of receiving an input of the course selection unit **140** or the option selection unit **160** may be further performed.

[0183] For example, the user may check the amount of the laundry through the course setting step S**4** and then input the course selection unit **140** or the option selection unit **160**. After confirming the execution time, the user may change the course or option by inputting the course selection unit **140** or the option selection unit **160**.

[0184] If the course setting step A**4** is performed, the controller P may perform a change displaying step A**5** of recalculating an estimated execution time or a detergent amount of a changed course or option corresponding to the amount of the laundry and then forwarding it to the display portion **16**.

[0185] In the change displaying step A**5**, one or more of the estimated execution time of the changed course or option and the changed detergent amount may be displayed on the display portion **16**.

[0186] If determining that the estimated execution time or the detergent amount is appropriate, the user may input the execution unit **170**. If the estimated execution time or the detergent amount is not appropriate, the user may re-input the course selection unit **140** or the option selection unit **160**.

[0187] If detecting the input of the execution unit **170**, the controller P may perform an execution inputting step A**6**. If detecting the input of the course selection unit **140** or the option selection unit **160**, the controller P may re-perform the course setting step A**4** and the change displaying step A**5**.

[0188] FIG. **7** shows another control method of detecting a laundry amount before an input of the execution unit **170** of the laundry treating apparatus of the present disclosure.

[0189] The controller P may be configured to detect an amount of laundry if detecting opening/closing of the door **13** before the execution unit **170** is inputted. Namely, a condition for detecting the amount of the laundry may include the opening/closing of the door **13**.

[0190] The laundry treating apparatus of the present disclosure may perform an opening/closing step B**1** of detecting opening/closing of the door **13**. If the opening/closing of the door **13** is detected in the opening/closing step B**1**, the controller P may perform a laundry amount detecting step B**2** of detecting an amount of laundry and an information displaying step B**3** of displaying one or more of the amount of the laundry, an execution time of a preset course or option, and a necessary detergent amount according to the detected laundry amount.

[0191] After the information displaying step B**3**, the controller P may perform an execution inputting step B**6** by detecting whether a user inputs the execution unit **170**, or may perform a course setting step B**4** and a change displaying step B**5** by detecting whether the user changes a course or option.

[0192] The information displaying step B**3**, the course setting step B**4**, the change displaying step B**5**, and the execution inputting step B**6** may be the same as the aforementioned embodiment.

[0193] If the door **13** is open/closed, it may mean that it is highly probable that the laundry is already put in the drum **30**. In addition, if the door **13** is opened/closed, it may mean that an amount of the laundry is increased/decreased in the drum **30**.

[0194] Accordingly, if detecting that the door **13** is opened/closed, the laundry treating apparatus of the present disclosure may immediately detect the amount of the laundry and then inform the user of the laundry amount itself, an estimated execution time of a course or option (or a changed execution time), and a necessary detergent amount (or a changed detergent amount).

[0195] FIG. **8** shows an additional control method of detecting a laundry amount before the execution unit **170** is inputted.

[0196] The laundry treating apparatus of the present disclosure may be configured to detect an amount of laundry when a user selects a desired course or option from a plurality of courses or options.

[0197] An estimated execution time necessary for a user or a necessary detergent amount may include an execution time or a detergent amount of a course or option selected by the user. Therefore, when a user selects a course or option, the laundry treating apparatus of the present disclosure may be configured to provide an estimated execution time or detergent amount corresponding to the selected course or option.

[0198] Meanwhile, a time point for a user to input the course selection unit **140** and the option selection unit **160** is after the power unit **120** is inputted, and highly likely, after laundry is put in the drum **30** via opening/closing the door **13**.

[0199] So to speak, if an estimated execution time or a detergent amount according to an amount of laundry is provided to a user after a time point when the course selection unit **140** and the option selection unit **160** are inputted, an estimated execution time or a detergent amount may be accurately provided to the user irrespective of whether the user is a person who has a habit of putting laundry in the drum **30** and then inputting the power unit **120** or a person who inputs the power unit **120** first and puts laundry into the drum **30**.

[0200] To this end, the laundry treating apparatus of the present disclosure may perform a course inputting step C**1** of detecting that the course selection unit **140** or the option selection unit **160** is inputted.

[0201] If detecting that the course selection unit **140** or the option selection unit **160** is inputted, the controller P may perform a laundry amount detecting step C**2** of detecting an amount of laundry.

[0202] Once the laundry amount detecting step C**2** is performed, the controller P may perform an information displaying step C**3** of displaying at least one of the amount of the laundry, an estimated execution time of a selected course or option corresponding to the amount of the laundry, and a detergent amount for performing the course or option on the display portion **16**.

[0203] After the information displaying step C**3**, the controller P may perform an execution inputting step C**6** of detecting whether a user inputs the execution unit **170**, or may perform a course setting step C**4** and a change displaying step C**5** by detecting whether the user changes a course or option.

[0204] The information displaying step C**3**, the course setting step C**4**, the change displaying step C**5**, and the execution inputting step C**6** may be the same as the aforementioned embodiment.

[0205] In some implementations, the laundry amount detecting step may be performed to start a course or option

before supplying water to the tub **20** or to detect a dewatered laundry amount to perform a dewatering cycle after draining the water from the tub **20**.

[0206] FIG. **9** shows an additional embodiment of a method of controlling a laundry treating apparatus of the present disclosure.

[0207] The laundry treating apparatus of the present disclosure may be configured to additionally detect a laundry amount even after performing a course or option according to an input to the execution unit **120** after laundry amount detection.

[0208] Accordingly, the laundry treating apparatus of the present disclosure may check whether an amount of laundry is too large to perform the course or option or whether an estimated laundry amount or a detergent amount is excessively represented as the laundry is excessively weighed due to a hydrated state of the laundry (i.e., wet laundry).

[0209] As a result, the laundry treating apparatus of the present disclosure not only quickly detects an amount of laundry, but also accurately detects a state of the laundry even afterwards, thereby making adjustment to perform an optimal course or option.

[0210] Referring to FIG. **9** (*a*), the laundry treating apparatus of the present disclosure may perform a power inputting step E**1** of supplying power by inputting the power unit **120**, an opening/closing step E**2** of detecting opening/closing of the door **13**, a laundry amount detecting step E**3** of detecting an amount of laundry if detecting the input to the power unit **120** and the opening/closing of the door **13**, and an information displaying step E**4** of displaying an execution time or a necessary detergent amount of a course or option corresponding to the amount of the laundry.

[0211] Thereafter, if a course setting step E**5** of setting a desired course or option by inputting one or more of the course selection unit **140** and the option selection unit **160** by a user, a change displaying step E**6** of displaying an execution time or a necessary detergent amount of the changed course or option may be performed.

[0212] If the user confirms the desired course or option in the information displaying step E**4** or the change displaying step E**6**, an execution inputting step E**7** of performing the course or option by inputting the execution unit **170** may be performed.

[0213] If the course or option is performed, the door **13** may be locked to the cabinet **10**.

[0214] The laundry treating apparatus of the present disclosure may perform an additional detecting step E**9** of additionally checking a state of the laundry when there is no risk of water, detergent, or laundry being discharged through the door **13**.

[0215] If the laundry amount, the estimated execution time and the necessary detergent amount are changed through the additional detecting step E**9**, the controller P may perform a final displaying step E**10** of immediately informing the user of the change.

[0216] Accordingly, when a situation change occurs in the matters provided to the user in the information displaying step E**4**, a control method corresponding thereto may be modified, and the modified control method may be provided to the user.

[0217] As a result, a course or option may be performed more appropriately for the laundry and an appropriate response of the user may be induced by informing the user of the changed situation.

[0218] For example, when a laundry amount value of the laundry is greater than a reference value for performing a course or option in the additional detecting step E**9**, the controller P may display guidance on stopping performing a course or option and withdrawing some of the laundry on the display portion **16** in the final displaying step E**10**.

[0219] Moreover, if detecting that the laundry, which is wet, is weighed excessively in the additional detecting step E**9**, the controller P may modify and display the estimated execution time or a remaining time or the necessary detergent amount on the display portion **16** in the final displaying step E**10**.

[0220] If the execution unit **170** is inputted, the controller P may re-calculate an estimated time of the arbitrary course or option by additionally detecting an amount of the laundry.

[0221] As described above, the controller may primarily detect a laundry amount of clothes before the execution unit is inputted, and may additionally detect a laundry amount when the execution unit is input.

[0222] The display portion may display an estimated execution time of the course or option corresponding to the primarily detected laundry amount before the execution unit is inputted, and may display an estimated execution time of the course or option corresponding to the additionally detected laundry amount when the execution unit is inputted.

[0223] When the execution unit is inputted, the display portion may change the estimated execution time of the course or option corresponding to the primarily detected laundry amount to the estimated execution time of the course or option corresponding to the additionally detected laundry amount and then display the changed estimated execution time.

[0224] The display portion may display the estimated execution time of the course or option corresponding to the additionally detected laundry amount longer than the estimated execution time of the course or option corresponding to the primarily detected laundry amount.

[0225] The secondarily displayed estimated execution time may last until the course or option is performed.

[0226] Meanwhile, when the controller P recalculates the course or option, the laundry amount may be more accurately detected.

[0227] To this end, the time for the controller P to additionally detect the laundry amount may be set to be longer than the time for primarily detecting the laundry amount.

[0228] The controller P may be provided to control the drive portion to detect the laundry amount. The drive portion may be controlled to intermittently rotate the drum primarily before the execution unit is inputted, and may be controlled to intermittently rotate the drum secondarily after the execution unit is inputted. In this case, the controller P may control the drive portion so that the angle or number of revolutions for intermittently rotating the drum secondarily is greater than the angle or number of revolutions for intermittently rotating the drum primarily. That is, the controller P may accurately detect the laundry amount through more information and time when additionally detecting the laundry amount.

[0229] In the laundry amount detecting step, the drive portion may rotate less than one rotation when performing the primarily intermittent rotation, thereby reducing the laundry amount detection time. Yet, when performing the

secondarily intermittent rotation, the drive portion may rotate more than one rotation, thereby promoting precision in laundry amount detection.

[0230] Meanwhile, the display portion may display that the estimated execution time of the course or option corresponding to the additionally detected laundry amount is a final estimated execution time.

[0231] FIG. **10** shows a method of controlling laundry amount detection in a laundry treating apparatus of the present disclosure.

[0232] As described above, the laundry treating apparatus of the present disclosure may perform a laundry amount detecting step of detecting an amount of laundry before an input of the execution unit **170**. The laundry amount detecting step described below may be performed in the aforementioned laundry amount detecting step.

[0233] The laundry amount detecting step may include a rotating step D**1** of rotating the drum and a calculating step D**3** of calculating a weight of laundry by measuring a first current value applied to or outputted in the rotating step.

[0234] The laundry treating apparatus of the present disclosure may rotate the drum **30** less than one revolution in the rotating step D**1**. Accordingly, the laundry treating apparatus of the present disclosure may detect an amount of the laundry before rotating the drum **30** at one revolution.

[0235] For example, the laundry amount detecting step may be terminated within **1** second. Accordingly, before determining that a user inputs the power unit **120**, opens/closes the door **13**, or selects the arbitrary course or option and inputs the execution unit **170**, one or more of an amount of the laundry and an estimated execution time and detergent amount based on the laundry amount may be displayed on the display portion **17**.

[0236] Accordingly, the user may select or change a course or option while checking the estimated execution time and the detergent amount, and input the execution unit **170**.

[0237] As a result, the laundry treating apparatus of the present disclosure may quickly detect an amount of laundry before finally determining to perform a course or option selected by a user, thereby providing an estimated execution time or a detergent amount.

[0238] In addition, a user may be prevented from waiting for a long time to check an estimated execution time and an appropriate detergent amount of a course or option selected by the user. As a result, washing delay can be prevented.

[0239] Meanwhile, in the laundry amount detecting step, the rotating step D**1** is terminated before the drum **30** makes one revolution. Hence, in the laundry amount detecting step, a restoring step D**2** of returning the drum **30** to an original position may be performed.

[0240] The calculating step D**3** may be performed when the rotating step D**1** is being performed or when the rotation step D**1** is terminated, and may be performed when both the rotating step D**1** and the restoring step D**2** are performed.

[0241] The laundry amount detecting step may further include a displaying step D**4** of displaying the amount of the laundry on the display portion **17** when the calculating step D**3** is terminated.

[0242] In the displaying step D**4**, the amount of the laundry may be displayed only, an estimated execution time of a specific course or option corresponding to the laundry amount may be displayed, or a required detergent amount necessary to perform the course or option may be displayed.

[0243] The laundry amount detecting step may be performed before an input of the execution unit **170**, or may be identically performed in an additional detecting step and the like performed after the execution unit **170** has been inputted.

[0244] Namely, in each of a dry laundry amount detecting step to perform a washing cycle and a wet laundry amount detecting step to perform a dewatering cycle, the same laundry amount detecting step may be performed. In addition, in a step of checking whether laundry is wet laundry or dry laundry, the laundry amount detecting step may be performed.

[0245] FIG. **11** shows an aspect of laundry amount detection in a laundry treating apparatus of the present disclosure.

[0246] Referring to FIG. **11** (*a*), a laundry may be disposed on a floor surface of the drum **30** by its own weight.

[0247] Referring to FIG. **11** (*b*), as the laundry amount detecting step is performed, if the rotating step D**1** is performed, the drum **30** may rotate right before making one revolution.

[0248] In the rotating step D**1**, the drum **30** may be rotated up to or less than an angle at which the laundry is separated from an inner wall of the drum or the disposition is varied. Accordingly, while the position of the laundry in the drum **30** is varied, unnecessary loads or impacts may be prevented from being transmitted to the drive portion **9**. Accordingly, the controller P may accurately calculate the load of the laundry through a current value applied to or output from the drive portion **9**.

[0249] For example, in the rotating step D**1**, the drum may be rotated in a range of 0° to 90° or less.

[0250] However, as the rotation angle of the drum **30** decreases, the time for the controller P to detect the laundry amount may be shortened, and an error in detecting the weight of the laundry may decrease. Accordingly, in the rotating step D**1**, it is preferable that the drum **30** rotates in a range of 10 degrees to 45 degrees or less.

[0251] FIG. **12** shows a laundry amount detection calculating method of a laundry treating apparatus of the present disclosure.

[0252] Referring to FIG. **12** (*a*) and FIG. **12** (*b*), once the laundry amount detecting step is performed, the controller P may rotate the drum **30** less than one revolution through the rotating step D**1**. In the calculating step D**3**, the controller P may calculate (process) an amount of the laundry by measuring a current value applied to or outputted from the drive unit **9** in the rotating step D**1**.

[0253] The controller P may use an equation of $Te=Jdw/dt+Bw+mgr\sin\Theta$ to detect the laundry amount.

[0254] Te is a torque value applied to the drive portion **9** and corresponds to 'I (current value)×K (drive portion constant)'. That is, since the drive portion constant k is an eigenvalue of the drive portion **9** itself, the controller P may calculate a torque value applied to the drive portion **9** when detecting the current value I.

[0255] Here, in the case of sin Θ in mgrsin Θ, as the rotation angle of the drum decreases, it decreases exponentially, and thus any angle between 15 and 90 degrees or between 10 and 45 degrees may be sufficiently ignored.

[0256] In addition, Bw is a friction torque, and when the drum **30** rotates, B becomes very small, so it may be ignored.

[0257] As a result, only the formula $Te=Jdw/dt$ may remain. In this case, since dw/dt is an angular acceleration for rotating the drum, the controller p may detect an angular

acceleration when rotating the drum in the rotating step d**1**. The angular acceleration may also be directly calculated through a current value applied to the drive portion **9**.

[0258] Therefore, when the current value is measured, both the torque value Te applied to the drive portion **9** and the angular acceleration dw/dt may be calculated, and thus an inertial moment J may be calculated.

[0259] As a result, the laundry treating apparatus of the present disclosure may immediately detect the amount of the laundry by grasping the inertial moment J.

[0260] FIG. **13** shows a process for calculating a laundry amount with an inertia moment in a laundry treating apparatus of the present disclosure.

[0261] In the storage unit, data for describing association between the inertia moment and the laundry amount may be stored.

[0262] If obtaining the weight of the laundry, it is able to detect an inertia moment generated when the laundry is rotated in the drum **30**. If obtaining the inertia moment, it is able to detect the weight of the laundry.

[0263] For example, if the controller P detects the inertia moment as 55000 in the calculating step D**3**, when the drum **30** is rotated counterclockwise, an amount of the laundry may be confirmed as 2 kg. When the drum **30** is rotated clockwise, the amount of the laundry may be confirmed as 3 kg.

[0264] Thus, the controller p may immediately detect the amount of the laundry through data obtained by arranging the inertial moment and the weight of the laundry stored in the storage unit p**2** based on a diameter of the drum **30**, a rotation direction of the drum **30** and the like.

[0265] Consequently, the controller P may detect the amount of the laundry by detecting only a current value applied or output in the rotating step D**1**. That is, the calculating step D**3** may be performed during the rotating step D**1** or at the moment when the rotating step D**1** is terminated.

[0266] As a result, the rotating step D**1** and the calculating step D**3** may be completely performed before the position of the drum **30** is restored to the original position. That is, the calculating step D**3** may already be terminated before the restoring step D**2** is terminated.

[0267] As a result, the rotating step D**1** and the calculating step D**3** may be entirely performed within 0.3 to 1 second, and the laundry amount detecting step itself may be performed within 0.3 to 1 second.

[0268] Therefore, the controller P may detect the laundry amount in an instant so that a user hardly feels the time for detecting the laundry amount and provide an execution time of a selected course or option.

[0269] Meanwhile, when the laundry amount is detected in the calculating step D**3**, the controller P may calculate and display an execution time or detergent amount of a course or option corresponding to the laundry amount almost at the same time.

[0270] As a result, the rotating step D**1**, the calculating step D**3**, and the displaying step D**4** may be entirely performed before the position of the drum is restored.

[0271] Therefore, the rotating step D**1**, the calculating step D**3**, and the displaying step D**4** may be entirely performed within 0.3 to 1 second.

[0272] FIG. **14** illustrates a basic structure in which the controller P measures a current value of the drive portion **9**.

[0273] Referring to FIG. **14** (*a*), the laundry treating apparatus **100** of the present disclosure may include the controller P capable of controlling the drive portion **9** by applying a current thereto and detecting a current discharged from the drive portion **9** as well.

[0274] The controller P controls the drive portion **9** according to a preset course or option, and the drive portion t **9** rotates a drum **4** according to a command of the controller P.

[0275] The controller P receives an operation signal or a control command from an input unit **14***a* and performs an operation. The input unit **14***a* may be provided with a washing course and an option selection unit for performing washing, rinsing, and dewatering cycles. Accordingly, the washing, rinsing, and dewatering cycles may be performed. In addition, the controller P may control a display portion **14***b* to display a washing course, washing time, dewatering time, rinsing time, etc., or a current operating stat and the like.

[0276] The controller P may control the drive portion **9** to rotate the drum **4** and may also vary the rotation speed of the drum **4**. Specifically, the controller P may control the drive portion **9** based on at least one of a current detection unit **225** that detects an output current flowing through the drive portion **9** and a position detection unit **220** that detects a position of the drive portion **230**. For example, one of the current detected by the drive portion **9** or the detected position signal may be fed back to a controller **210**, and the controller **210** may generate a current signal capable of appropriately controlling the drive portion **9** according to the feedback signal.

[0277] Meanwhile, in the laundry treating apparatus of the present disclosure, the position detection unit **235** may be omitted and a position of the drive portion **9** may be detected through the implementation of a separate algorithm. (so-called, a sensor-less drive portion). The sensor-less drive portion **9** may be configured such that the controller P measures the current or voltage outputted from the drive unit **9** to enable the drive unit **9** to obtain a position of a rotor or stator.

[0278] Hereinafter, an embodiment in which the controller P controls the drive portion **9** will be described.

[0279] The drive portion P may be provided as a three-phase motor to control a rotation speed, for example, a BLDC motor.

[0280] Referring to FIG. **14** (*b*), the controller P may include an inverter **420** and an inverter controller **430** to control the rotor and the stator described above. In addition, the controller P may further include a converter **410** that supplies DC power input to the inverter **420**, and the like.

[0281] That is, the controller P may simultaneously serve as the inverter controller **430**. Of course, the inverter controller **430** may be provided separately from the controller P. When the inverter controller **430** outputs a switching control signal Sic of a Pulse Width Modulation (PWM) type to the inverter **420**, the inverter **420** may perform a high-speed switching operation and supply AC power at a predetermined frequency to the rotor **913** and the stator **911**.

[0282] The laundry treating apparatus of the present disclosure may further include a DC stage voltage detection unit B, a smoothing capacitor C, and an output current detection unit E as well as the converter **410**, the inverter **420**, and the inverter controller **430**. In addition, the laundry

treating apparatus of the present disclosure may further include an input current detection unit A, a reactor L, and the like.

[0283] The reactor L is disposed between a commercial AC power source (vs) **405** and the converter **410** to perform a power factor correction or boosting operation. In addition, the reactor L may perform a function of limiting a harmonic current due to high-speed switching of the converter **410**.

[0284] The input current detection unit A may detect an input current (is) inputted from the commercial AC power source **405**. To this end, a Current Transformer (CT), a shunt resistor, or the like may be used as the input current detection unit A. The detected input current (is) is a pulse-type discrete signal and may be inputted to the inverter controller **430**.

[0285] The converter **410** converts the commercial AC power source **405** that has passed through the reactor L into a DC power source and outputs it. Although the commercial AC power source **405** is illustrated as a single-phase AC power source in the drawing, it may also be a three-phase AC power source. The internal structure of the converter **410** is also changed according to the type of the commercial AC power source **405**.

[0286] Meanwhile, the converter **410** may consist of a diode and the like without a switching element, and may perform a rectifying operation without a separate switching operation. For example, in the case of a single-phase AC power source, four diodes may be used in a bridge form, and in the case of a three-phase AC power source, six diodes may be used in a bridge form.

[0287] The converter **410** may use a half-bridge type converter in which two switching elements and four diodes are connected. In the case of a three-phase AC power source, six switching elements and six diodes may be used. When the converter **410** includes a switching element, a boosting operation, a power factor improvement, and a DC power conversion may be performed by a switching operation of the corresponding switching element.

[0288] The smoothing capacitor C smooths an inputted power and stores the smoothed power. In the drawings, one device is illustrated as the smoothing capacitor C, but a plurality of devices may be provided to ensure device stability.

[0289] The converter **410** may be connected to an output terminal, but DC power may be directly inputted. For example, DC power from a solar cell may be directly inputted to the smoothing capacitor C or may be inputted by DC/DC conversion. As DC power is stored, both ends of the smooth capacitor C may be referred to as a dc stage or a dc link stage.

[0290] The dc stage voltage detection unit B may detect a voltage Vdc of the dc stage corresponding to both ends of the smoothing capacitor C. To this end, the DC stage voltage detection unit B may include a resistance element, an amplifier, and the like. The detected dc stage voltage Vdc is a pulse-type discrete signal and may be inputted to the inverter controller **430**.

[0291] The inverter **420** may include a plurality of inverter switching elements, convert a DC power source Vdc smoothed by an on/off operation of the switching element into three-phase AC power sources va, vb, and vc of a prescribed frequency, and output the same to the drive portion **9**. The inverter **420** is a pair of upper arm switching elements Sa, Sb, Sc) and lower arm switching elements S'a, S'b, and S'c, which are connected in series with each other, respectively, and a total of three pairs of upper and lower arm switching elements (i.e., Sa&S'a,Sb&S'b,Sc&S'c) may be connected in parallel together.

[0292] Diodes are connected to the switching elements Sa, S'a, Sb, S'b, Sc, and S'c in reverse parallel, respectively.

[0293] The switching elements in the inverter **420** turn on/off operations of the switching elements based on an inverter switching control signal Sic from the inverter controller **430**, whereby the three-phase AC power having a prescribed frequency is outputted to the drive portion **9**.

[0294] The inverter controller **430** may control a switching operation of the inverter **420**. To this end, the inverter control unit **430** may receive an input of an output current io detected by an output current detection unit E.

[0295] The inverter controller **430** outputs the inverter switching control signal Sic to the inverter **420** in order to control the switching operation of the inverter **420**. The inverter switching control signal Sic is a switching control signal of Pulse Width Modulation (PWM), and is generated and outputted based on the output current value io detected from the output current detection unit E.

[0296] The controller P may detect the output current value io detected by the current detection unit **220** to detect the state inside the drum. In addition, the controller P may detect a state inside the drum based on a position signal H detected by the position detection unit **235**. For example, while the drum **40** rotates, it is possible to detect a laundry amount, a dewatering rate, a moisture content, and the like based on the output current value io of the drive portion **9**. In addition, the controller P may detect an eccentric amount of the drum **4**, that is, an Unbalance UB of the drum **4**. This eccentricity detection may be performed based on a ripple component of the current io detected by the current detection unit **220** or a variation of the rotation speed of the drum **4**.

[0297] In addition, the controller P may detect a state inside the drum by detecting an input current value (is) inputted to the inverter controller. A process of detecting the state inside the drum through the current value and a calculation method will be described later.

[0298] The output current detection unit E may be provided to detect an output current io flowing between the inverter **420** and the three-phase drive portion **9**. The output current detection unit E detects a current flowing through the drive portion **9**. The output current detection unit E may detect all of the output power currents ia, ib, and ic of the phases, and may detect output power currents of two phases using three-phase equilibrium.

[0299] The output current detection unit E may be positioned between the inverter **420** and the drive portion **9**, and a Current Transformer (CT), a shunt resistor, and the like may be used for current detection. When the shunt resistor is used, three shunt resistors may be positioned between the inverter **420** and the drive portion **9**, or one ends thereof may be connected to the three lower arm switching elements S'a, S'b, and S'c of the inverter **420**, respectively.

[0300] Meanwhile, it is also possible to use two shunt resistors using three-phase equilibrium. In addition, when a single shunt resistor is used, the corresponding shunt resistor may be disposed between the capacitor C and the inverter **420** described above.

[0301] The detected output current io is a pulse-type discrete signal that may be applied to the inverter controller **430**, and an inverter switching control signal Sic is generated

based on the detected output current io. Hereinafter, it will be described that the detected output current io includes three-phase output currents ia, ib, and ic.

[0302] Meanwhile, the three-phase drive portion **9** has a stator and a rotor, and each current power of a prescribed frequency is applied to a coil of the stator of each of the phases a, b, and c, whereby the rotor rotates.

[0303] Such a drive portion **9** may include a Surface-Mounted Permanent-Magnet Synchronous Motor (SMPMSM), an Interior Permanent Magnet Synchronous Motor (IPMSM), and a Synchronous Reluctance Motor (Synrm). Among them, the SMPMSM and the IPMSM are Permanent Magnet Synchronous Motors (PMSM) using permanent magnets, and the Synrm is characterized in having no permanent magnet.

[0304] Meanwhile, when the converter **410** includes a switch element, the inverter controller **430** may control a switching operation of the switching element in the converter **410**. To this end, the inverter controller **430** may receive an input current (is) detected by the input current detection unit A. And, the inverter controller **430** may output a converter switching control signal Scc to the converter **410** to control the switching operation of the converter **410**. The converter switching control signal Scc is a switching control signal of a Pulse Width Modulation (PWM) type, and may be generated and outputted based on the input current (is) detected by the input current detection unit A.

[0305] Meanwhile, the position detection unit **235** may detect a rotor position of the drive portion **9**. To this end, the position detection unit **235** may include a hall sensor. The detected rotor position H is inputted to the inverter controller **430**, thereby being basically used for speed calculation and the like.

[0306] FIG. **14** (*c*) illustrates one embodiment of a detailed circuit structure in which the inverter controller **430** controls the drive portion **9**. The inverter controller **430** may include an axial transform unit **510**, a speed calculation unit **520**, a current command generation unit **530**, a voltage command generation unit **540**, an axial transform unit **550**, and a switching control signal output unit **560**.

[0307] The axial transform unit **510** receives the three-phase output currents ia, ib, and is detected by the output current detection unit E and transforms them into two-phase currents iα and iβ of the stationary coordinate system. The axial transform unit **510** may transform the two-phase currents iα and iβ of the stationary coordinate system into the two-phase currents id and iq of a rotary coordinate system.

[0308] The speed calculation unit **520** may calculate a speed based on the position signal H of the rotor inputted from the position detection unit **235**. That is, based on the position signal, when it is divided over time, the speed may be calculated. The speed calculation unit **520** may output a position and speed calculated based on the inputted position signal H of the rotor.

[0309] The current command generation unit **530** generates a current command value i*q based on a calculation speed w and a speed command value ω*r. For example, the current command generation unit **530** may perform PI control in the PI controller **535** based on the difference between the calculation speed w and the speed command value ω*r, and may generate the current command value i*q. In the drawing, a q-axis current command value i*q is illustrated as a current command value, but unlike the drawing, a d-axis current command value i*d may be generated together. Meanwhile, the value of the d-axis current command value i*d may be set to 0.

[0310] Meanwhile, the current command generation unit **530** may further include a limiter that limits the level of the current command value i*q so that it does not exceed an allowable range. Next, the voltage command generation unit **540** generates d-axis and q-axis voltage command values v*d and v*q based on the d-axis and q-axis currents id and iq axially transformed into a two-phase rotary coordinate system in the axial transform unit and the current command values i*d and i*q in the current command generation unit **530** and the like. For example, the voltage command generation unit **540** may perform PI control in the PI controller **544** based on the difference between the q-axis current iq and the q-axis current command value i*q, and may generate a q-axis voltage command value v*q. In addition, the voltage command generation unit **540** may perform PI control in the PI controller **548** based on the difference between the d-axis current id and the d-axis current command value i*d, and may generate a d-axis voltage command value v*d. Meanwhile, the value of the d-axis voltage command value v*d may be set to 0 so as to correspond to the case where the value of the d-axis current command value i*d is set to 0.

[0311] Meanwhile, the voltage command generation unit **540** may further include a limiter that limits the level of the d-axis and q-axis voltage command values v*d and v*q)so that they do not exceed the allowable range.

[0312] Meanwhile, the generated d-axis and q-axis voltage command values v*d and v*q are inputted to the axial transform unit **550**.

[0313] The axial transform unit **550** receives the position Θ calculated by the speed calculation unit **520** and the d-axis and q-axis voltage command values v*d and v*q, and performs axial transform. First, the axial transform unit **550** performs transform from the two-phase rotary coordinate system to the two-phase stationary coordinate system. In this case, the position Θ calculated by the speed calculation unit **520** may be used.

[0314] In addition, the axial transform unit **550** performs transform from the two-phase stationary coordinate system to the three-phase stationary coordinate system. Through such transform, the axial transform unit **1050** outputs three-phase output voltage command values v*a, v*b, and v*c.

[0315] The switching control signal output unit **560** generates and outputs a switching control signal Sic for an inverter according to Pulse Width Modulation (PWM) based on the three-phase output voltage command values v*a, v*b, and v*c.

[0316] The outputted inverter switching control signal Sic may be converted into a gate drive signal by a gate drive unit and inputted to a gate of each switching element in the inverter **420**. Accordingly, each of the switching elements Sa, S'a, Sb, S'b, Sc, and S'c in the inverter **420** performs a switching operation.

[0317] Meanwhile, the switching control signal output unit **560** may generate and output an inverter switching control signal Sic obtained by mixing two-phase pulse width modulation and three-phase pulse width modulation together according to an embodiment of the present disclosure.

[0318] For example, in an accelerated rotation interval described later, an inverter switching control signal Sic by

three-phase pulse width modulation may be generated and outputted. In order to detect counter electromotive force in a constant speed rotation interval, an inverter switching control signal Sic by two-phase pulse width modulation may be generated and outputted.

[0319] FIG. **15** illustrates an additional embodiment of detecting a laundry amount by the controller P.

[0320] The laundry treating apparatus of the present disclosure may perform a detecting step F of detecting a laundry amount inside the drum **4** before performing a washing cycle, a rinsing cycle, and a dewatering cycle.

[0321] To this end, the controller P may perform an acceleration step F**1** of accelerating the drum **4**, a deceleration step F**2** of decelerating the drum **4**, and a laundry amount detection step F**3** of detecting a laundry amount received in the drum through an acceleration measurement value of the drive portion **9** in the acceleration step and a deceleration measurement value of the drive portion in the deceleration step.

[0322] The laundry treating apparatus of the present disclosure detects an acceleration measurement value measured by the drive portion **9** or applied to the drive portion **9** while accelerating the drive portion **9**, and also detects a deceleration measurement value measured by the drive portion **9** or applied to the drive portion **9** while decelerating the drive portion **9**. Thereafter, the acceleration measurement value and the deceleration measurement value are calculated to detect the laundry amount received in the drum **4**.

[0323] The acceleration measurement value and the deceleration measurement value may be the command values applied to the drive portion **9** while driving the drive portion **9**, or may be the measurement values measured by the drive portion **9** while driving the drive portion **9**.

[0324] For example, the command value may be a current command value or a voltage command value derived from the PI controller **535**, which is applied to drive the drive portion **9**, and the above measured value may be a current or voltage value of the drive portion **9**, which is measured by the position detection unit **235** or the current detection unit **225**.

[0325] Accordingly, the laundry treating apparatus of the present disclosure may skip the step of maintaining the drive portion **9** at a constant speed, thereby significantly reducing the time required to detect the laundry amount.

[0326] In addition, the laundry treating apparatus of the present disclosure may save not only the process of maintaining the drive portion **9** at a constant speed, but also the energy and time required to maintain the constant speed. In addition, the laundry treating apparatus of the present disclosure may completely ignore the frictional force of the drive portion **9** itself, which must be overcome when the drive portion **9** is maintained at the constant speed, in the calculation process.

[0327] When the controller P uses the command value when detecting the laundry amount, the controller P does not need to feedback an actual situation to the drive portion **9** or consider an actual driving situation of the drive portion **9**. Accordingly, it may be simple and easy for the controller P to calculate a laundry amount value. In addition, since the calculation equation for calculating the laundry amount becomes simple, the laundry amount value may be quickly obtained.

[0328] Specifically, the acceleration measurement value may include an acceleration current value Iq_Acc measured by the drive portion **9**, and the deceleration measurement value may include a deceleration current value Iq_Dec measured by the drive portion **9**.

[0329] The acceleration current value may include a current command value Iq*_Acc for rotating the drive portion **9** in the acceleration step, and the deceleration current value may include a current command value Iq*_Dec for rotating the drive unit **9** in the deceleration step.

[0330] On the other hand, if the measurement value is used when the controller P detects the laundry amount, since the drive portion **9** reflects the actual situation as it is, there is an advantage in that the laundry amount value may be accurately obtained.

[0331] In addition, the command value is generated only when the drive portion **9** is driven or controller actively by having a power applied thereto. Therefore, the advantage of using the above measured value is that data for detecting the laundry amount may be obtained even when the power is cut off to the drive portion **9** or the drive portion **9** is not actively controlled.

[0332] The laundry treating apparatus of the present disclosure may decelerate the drive portion **9** by power generation braking in a manner of cutting off power in the deceleration step F**2**. Accordingly, an algorithm for controlling the deceleration step F**2** may be omitted, and energy for the deceleration step F**2** may be saved.

[0333] Furthermore, since the power is cut off in the deceleration step F**2**, the voltage command value may be 0. Therefore, according to the present disclosure, a laundry amount may be detected by calculating only a current except a voltage.

[0334] That is, the method of controlling the laundry treating apparatus of the present disclosure may ignore or not use a voltage command value or a voltage value itself. Since the method uses only a current value, it is very simple to have a calculation equation for laundry amount detection. Since the calculation equation is simplified, the calculation can be quickly and accurately performed, whereby a laundry amount may be accurately detected.

[0335] Specifically, data and algorithm (hereinafter, calculation equation) for calculating the acceleration measurement value and the deceleration measurement value may be stored in the controller P. The calculation equation may be provided so as not to use a voltage value from the beginning. For this reason, it is not necessary to calculate a counter electromotive force, whereby the present disclosure may omit the constant speed rotation step of the drive portion **9**.

[0336] For example, the calculation equation of the present disclosure may be provided as follows.

[0337] Laundry amount value (inertia, Jm, Load_data) of the present disclosure

$$= \frac{3}{2}\frac{P}{2}K_e \frac{i_q^{Acc} - i_q^{Dec}}{\Delta\omega_m^{Acc}/\Delta t_{Acc} - \Delta\omega_m^{Dec}/\Delta t_{Dec}}$$

[0338] may be calculated by the following equation. The P and Ke are constant values of the drive portion **9** itself, and may be measured by the controller P. A denominator corresponds to a difference between a speed variation in the acceleration step and a speed variation in the deceleration stage.

[0339] The speed variation may be measured by the controller P owing to the position detection unit **235**, calculated

by measuring a time reached until the acceleration or deceleration, or immediately detected by measuring a current or the like.

[0340] Therefore, in the present disclosure, a laundry amount may be immediately calculated only by measuring an acceleration output current value Iq_Acc at the acceleration and an acceleration output current value Iq_Dec at the deceleration. In other words, the acceleration current value may be regarded as including an acceleration output current value Iq_Acc outputted from the drive portion during the acceleration step, and the deceleration current value may be regarded as including a deceleration output current value Iq_Dec outputted from the drive portion during the deceleration step.

[0341] Furthermore, an average value Iqe_Acc of the current value measured by the drive portion during the acceleration step may be applied to the acceleration output current value, and an average value Iqe_Dec of the current value measured by the drive portion during the deceleration step may be applied to the deceleration output current value..

[0342] In any case, the laundry amount may be calculated with only one factor of a current value, and a factor of a voltage value may be omitted, thereby simplifying a laundry amount calculation and improving the promptness and accuracy of the capacity value.

[0343] Therefore, even if the time of the acceleration step is very short or the time of the acceleration step is very short, the laundry amount can be accurately detected, whereby the time taken for laundry amount detection may be further reduced.

[0344] Meanwhile, in the laundry amount detection of the laundry treating apparatus of the present disclosure, a laundry amount is detected in a manner of accelerating and then decelerating immediately. Therefore, the time for measuring the laundry amount itself is very short, and laundry inside the drum **4** cannot move or flow during the time. Accordingly, since the laundry amount may be detected in a short time when a state of the laundry does not change, accuracy may be further increased in the laundry amount calculation.

[0345] Meanwhile, the calculation equation applied to the laundry amount detection of the present disclosure uses the difference between the current value of the acceleration step and the current value of the deceleration step. Therefore, a friction force of the drive portion in the acceleration step and the friction force of the drive portion in the deceleration step are the same, so the compensation equation of the current considering the friction force is offset. Therefore, the method of controlling the laundry amount detection in the laundry treating apparatus of the present disclosure does not need to consider the friction force of the drive portion **9**, so a process of correcting or tuning the friction force may be omitted. Furthermore, since a voltage value is not used in the present disclosure, a process of compensating or tuning a voltage value error may be omitted. As a constant speed process is omitted, a process of compensating or tuning laundry movement or a friction force of the drive portion **9** may be omitted. As a result, the method of controlling the laundry amount in the laundry treating apparatus of the present disclosure derives a laundry amount as soon as a current value is substituted, and since there is no procedure for compensating or tuning the laundry amount, the laundry amount may be detected very quickly and accurately.

[0346] Therefore, the amount of load required for the controller P may be reduced, the controller P may be replaced with a relatively simple configuration, or the performance of the controller P may be utilized in other directions.

[0347] Meanwhile, as can be seen in the above calculation equation, the acceleration measurement value may further include a speed variation of the acceleration step **F1**, and the deceleration measurement value may further include a speed variation of the deceleration step **F2**.

[0348] The speed variation of the acceleration step **F1** and the speed variation of the deceleration step **F2** are only required to obtain a difference between the inertia of the acceleration step **F1** and the inertia of the deceleration step **F2**, and may not require a separate voltage value measurement and the like, and furthermore, no compensation or tuning process is required.

[0349] In more detail, the calculation equation is derived by the following calculation equations.

$$\text{Acceleration Inertia} = \frac{T_e^{ACC}}{D_m^{Acc} - D_m^{Dec}}$$

$$\text{Deceleration Inertia} = \frac{T_e^{Dec}}{D_m^{Acc} - D_m^{Dec}}$$

$$\text{where } D_m = \frac{d\omega_m}{dt} = \frac{\Delta\omega_m}{\Delta t}$$

[0350] In this case, since the laundry amount is calculated through the difference between the acceleration inertia and the deceleration inertia, the variation is required for the speed.

[0351] Therefore, if the acceleration measurement value and the deceleration measurement value are measured in the same RPM interval of the drum, the operation may be simplified because the width of the speed change is the same. That is, it is preferable that the acceleration step **F1** and the deceleration step **F2** share the same speed band.

[0352] Meanwhile, the control method of the laundry treating apparatus of the present disclosure performs the acceleration step **F1** and deceleration step **F2** to detect a laundry amount using a current command value or a current value measured by the drive portion **9**.

[0353] In this case, since the calculation equation uses a current value, a laundry amount may be detected through the same calculation equation by measuring a current value in a manner of performing the deceleration step **F2** first and then performing the acceleration step Bb.

[0354] Meanwhile, the detection step **F3** may perform a preparation step **F0** of checking a position of the drive portion **9** in order to set reference values for performing the acceleration step **F1** and the deceleration step **F2**. In the preparation step **F0**, the drum **4** may be disposed in a stopped state.

[0355] The acceleration step **F1** may additionally accelerate the drum stopped in the preparation step **F0** to a first rpm, and the deceleration step **F2** may decelerate the drum at a first rpm. That is, the acceleration step **F1** and the deceleration step **F2** may be continuously performed. In the deceleration step **F2**, a current command value toward the drive portion **9** in the acceleration step **F1** may be lowered or a voltage applied to the drive portion **9** may be blocked, and thus the controller P or the circuit may not be damaged.

[0356] In this case, the acceleration measurement value and the deceleration measurement value may be measured

between the first rpm and a second rpm lower than the first rpm. That is, a current value may be measured in an interval band including a vertex in the speed graph to detect a laundry amount. This has an advantage in that a situation in which an error may occur may be minimized since a current value is measured in a continuous situation to detect the laundry amount.

[0357] Meanwhile, the acceleration measurement value and the deceleration measurement value may be measured between the second rpm lower than the first rpm and a third rpm higher than the second rpm and lower than the first rpm. That is, although it is not the interval including the vertex, a current value may be measured in the same speed interval band to detect a laundry amount. This has an advantage of improving the accuracy of the laundry amount calculation by measuring a stabilized current value as the speed change is the largest at the vertex.

[0358] Meanwhile, the first rpm may be set to a lower rpm than a fixed rpm at which laundry received in the drum **4** is attached to the inner wall of the drum **4**. That is, the first rpm may be relatively lower than the rpm applied in a washing, rinsing, or dewatering cycle.

[0359] The acceleration step F**1** may correspond to the rotation step D**1**, and the deceleration step F**2** may correspond to the restoration step D**2**. As a result, the restoration step D**2** may be a step of applying a current to the controller P actively to rotate the drive portion **9** in reverse.

[0360] The laundry amount detection step F**3** corresponds to the calculation step D**3**, and the calculation step D**3** may immediately detect a laundry amount through the current value of the rotation step D**1** and the current value of the restoration step D**2**.

[0361] In this case, a process of directly calculating the moment of inertia by the controller P or a process of comparing the moment of inertia with the laundry amount data of clothes stored in the storage unit P**2** and extracting it may be omitted.

[0362] A current amount applied in the rotation step D**1** may be defined as a first current amount, and a current amount applied in the deceleration step F**2** may be defined as a second current. The controller P may detect the laundry amount through the first current amount and the second current amount.

[0363] FIG. **16** illustrates another embodiment in which the controller P detects a laundry amount.

[0364] The embodiment of FIG. **16** illustrates that the restoration step D**2** of FIG. **15** is not the deceleration step of applying a current that rotates the drum **30** in reverse to the drive portion **9**, but corresponds to an interruption step F**2'** in which the drive portion **9** is decelerated while restored by the weight of the clothes by cutting off the power applied to the drive portion **9**.

[0365] The controller P may detect counter electromotive force generated in the interruption step F**2'**, measure a current value corresponding to the counter electromotive force, and detect a laundry amount through the calculation method shown in FIG. **14**.

[0366] Even in this case, the process of directly calculating the moment of inertia by the controller P or the process of comparing the moment of inertia with the laundry amount data of the laundry stored in the storage unit P**2** and then extracting it may be omitted.

[0367] An amount of a current applied in the rotation step D**1** may be defined as a first current amount, and an amount of a current applied in the interruption step F**2'** may be defined as a third current amount. The controller P may detect the laundry amount through the first current amount and the third current amount.

[0368] As described above (refer to Background Art of the disclosure), since the related art laundry treating apparatus detects a laundry amount after a course or option has been executed, a user cannot recognize the amount of the laundry until the course or option is selected and executed.

[0369] In addition, since the related art laundry treating apparatus rotates a drum at least one rotation or more when detecting a laundry amount, it is unable to quickly perform laundry amount detection, and thus the laundry amount is displayed relatively late even after execution of a course or option.

[0370] Therefore, in the case of the related art laundry treating apparatus, since a user does not recognize a laundry amount before executing a course or option, there is no room for putting a suitable detergent, and a detergent is excessively added to ensure washing performance. This not only wastes the detergent, but also damages health as residual detergent remains in the laundry, and causes environmental pollution.

[0371] In addition, in case of the related art laundry treating apparatus, a user usually leaves the laundry treating apparatus without waiting until detecting a laundry amount after executing a course or option, thereby failing to check an execution time or end time of the course or option.

[0372] Accordingly, the user often has to visit the laundry treating apparatus to check the end of the course or option. In addition, in the related art laundry treating apparatus, laundry is left in the drum for a long time even after the course or option is terminated, causing wrinkles in the laundry, or in severe cases, decomposition of the laundry may occur.

[0373] Furthermore, since the related art laundry treating apparatus performs the locking of a door when a course or option is executed, there is no possibility for a user to adjust a laundry amount thereafter.

[0374] However, a laundry treating apparatus of the present disclosure may detect and display a laundry amount before execution of a course or option.

[0375] Accordingly, a user may recognize a laundry amount before executing a course or option and input a detergent in consideration of an appropriate detergent amount corresponding thereto. For example, a user may check a detergent amount corresponding to a laundry amount displayed on a detergent container, and may put the checked detergent into the laundry treating apparatus.

[0376] As a result, the laundry treating apparatus of the present disclosure can save a detergent, solve the problem of excessive detergent remaining in the laundry after the end of a course, and prevent environmental pollution.

[0377] In addition, since the laundry treating apparatus of the present disclosure detects a laundry amount by rotating a drum less than one revolution, even if the laundry amount is detected before execution of a course or option, it does not cause washing delay and the like or inconvenience to a user.

[0378] For example, in the laundry treating apparatus of the present disclosure, when a power unit is inputted or opening/closing of a door is detected due to the input of laundry, a laundry amount is detected and displayed within **3** seconds, so that a washing delay is not caused.

[0379] In addition, the laundry treating apparatus of the present disclosure may detect a laundry amount before executing a course or option and display an estimated time or an end time of the course or option corresponding to the laundry amount.

[0380] Accordingly, in a process for selecting a prescribed course or option from arbitrary courses or options, a user may recognize an estimated time or an end time of each course or option. Thus, the user may select a course or option suitable for a current schedule.

[0381] In addition, a user may recognize an estimated time or end time of a course or option before executing the course or option. Therefore, since the user checks the estimated time or the end time and then executes the course or option, it is possible to reduce the trouble of checking the laundry treating apparatus until the end of the course or option. Furthermore, since the user can recognize the end time of the course or the option, it is possible to prevent laundry from being left inside a drum after the end of the course.

[0382] In addition, since the laundry treating apparatus of the present disclosure does not lock the door before executing a course or option, a laundry amount is detected and displayed before the door is locked. Accordingly, a user may further put or withdraw laundry by checking the displayed laundry amount.

[0383] For example, if a user determines that there is too much laundry amount to perform a specific course or option, the user withdraws some of laundry to prevent an operation of the laundry treating apparatus from being interrupted due to future eccentricity and over-vibration.

[0384] For example, when a user confirms that laundry is bulky but weighs less, more laundry can be added to prevent contaminated laundry from being left unattended for a long time.

[0385] As described above, unlike the related art laundry treating apparatus, the laundry treating apparatus of the present disclosure quickly detects a laundry amount, and thus displays the laundry amount or an estimated execution time before executing a course or option or locking a door, thereby deriving the aforementioned remarkable effects.

[0386] It will be apparent to those skilled in the art that various modifications and variations can be made in the present disclosure without departing from the spirit or scope of the inventions. Thus, it is intended that the present disclosure covers the modifications and variations of this disclosure provided they come within the scope of the appended claims and their equivalents.

1-20. (canceled)

21. A laundry treating apparatus comprising:

a cabinet having an opening in the front of thereon;

a door coupled to the cabinet to open and close the opening;

a locking portion locking the door to the cabinet;

a drum provided inside the cabinet to accommodate laundry;

a driving portion connected to the drum to rotate the drum; and

a control panel including a power supply portion that receives a command to supply power;

wherein the drive portion is provided to rotate the drum less than one revolution in a state in which the lock portion unlocks the door based on the power portion is input.

22. The laundry treating apparatus of claim **21**, wherein the drive portion is provided to rotate the laundry below an angle at which the laundry are separated from the inner wall of the drum or the location of the laundry is changed in the drum, in a state in which the lock portion unlocks the door.

23. The laundry treating apparatus of claim **21**, wherein the drive portion rotates the drum by less than 90 degrees in a state in which the lock portion unlocks the door.

24. The laundry treating apparatus of claim **23**, wherein the driving portion is provided to rotate the drum within a range of 10 degrees to 45 degrees or less, and return it to its original state, in a state in which the lock portion unlocks the door.

25. The laundry treating apparatus of claim **23**, wherein the driving portion is provided to rotate the drum within 0.3 seconds to 1 second in a state in which the lock portion unlocks the door.

26. The laundry treating apparatus of claim **21**, wherein the control panel further comprises a display portion for displaying information on the outside, and

wherein the display portion is provided to display at least one of a weight of the laundry and an execution time of a course for treating the laundry after the drum starts to rotate.

27. The laundry treating apparatus of claim **26**, wherein the display portion is provided to display at least one of the weight of the laundry and the execution time of a course for treating the laundry before the drum stops.

28. The laundry treating apparatus of claim **27**, wherein the control panel further includes an execution portion that receives an execution command for executing the course, and

wherein the execution portion is provided to able to input the execution command in a state in which at least one of the weight of the laundry and the execution time of the course for treating the laundry is displayed on the display portion.

29. The laundry treating apparatus of claim **28**, wherein the locking portion is provided to lock the door to the cabinet based on that the execution portion is input.

30. The laundry treating apparatus of claim **27**, wherein the control panel further includes a course selection portion that receives a selection command for selecting the course, and

wherein the course selection portion is provided to allow input of the selection command while at least one of the weight of the laundry and the execution time of the course for processing the laundry is displayed on the display portion.

31. The laundry treating apparatus of claim **21**, wherein the laundry treating apparatus further comprises a sensing portion for detecting whether the door is opened or closed, and

wherein the drive portion is provided to rotate the drum after the door opens and closes the opening.

32. The laundry treating apparatus of claim **31**, wherein the drive portion is provided to rotate the drum again based on that the door opens and closes the opening again, even after the drum stops after rotating.

33. The laundry treating apparatus of claim **21**, wherein the drive portion is provided to rotate the drum in a state in which the lock unit unlocks the door, wherein the driving portion is provided to rotate the drum again after the locking portion locks the door.

34. The laundry treating apparatus of claim **33**, wherein the drive portion is provided to rotate the drum longer when the lock portion locks the door than when the lock portion unlocks the door.

35. The laundry treating apparatus of claim **33**, wherein the driving portion is provided to rotate the drum at a larger angle when the lock portion locks the door than when the lock portion unlocks the door.

36. The laundry treating apparatus of claim **35**, wherein the drive portion is provided to rotate the drum one rotation or more in a state in which the lock unit locks the door.

37. The laundry treating apparatus of claim **33**, wherein the control panel further includes a display portion for displaying information on the outside,

wherein the display portion is provided to display at least one of a weight of the laundry and an execution time of a course for treating the laundry in a state in which the locking portion unlocks the door, and

wherein the display portion is provided to display again at least one of the weight of the laundry and the execution time of the course for treating the laundry in a state in which the locking portion locks the door.

38. The laundry treating apparatus of claim **37**, wherein the display portion is provided to change the execution time of the course to a remaining time of the course in a state in which the locking portion locks the door.

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