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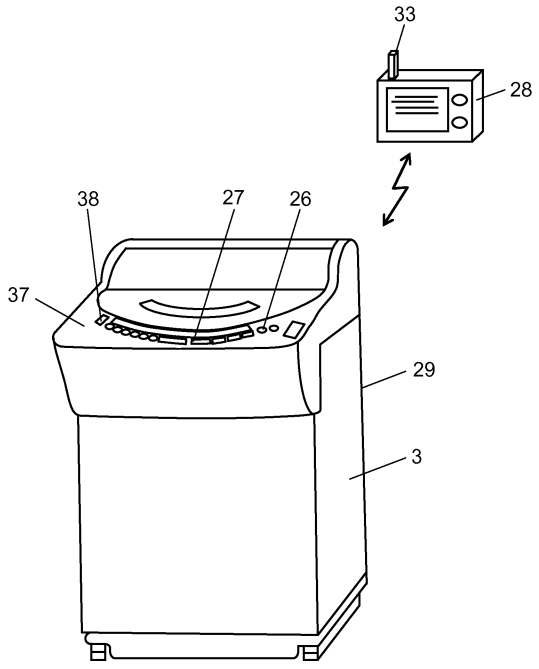
(54) WASHING MACHINE AND WASHING MACHINE CONTROL SYSTEM

(57) A washing machine (29) configured to communicate with a terminal device (28) via wireless communication includes a controller for controlling operation and communication of the washing machine (29), and an operation display unit (37) disposed in an upper part of the washing machine (29) and extended in the left-right direction, for determining and displaying a setting of an operation course. The operation display unit (37) includes a power-on switch for turning on a power source, a display unit (26) for displaying setting contents of the operation course, and a washing machine transmitter-receiver (38) for communicating with the terminal device (28). The controller receives, via the washing machine transmitter-receiver (38), information on the operation course transmitted from the terminal device (28), and displays the operation course and controls operation of the operation course based on the information on the operation course. The power-on switch is disposed in either the left side or the right side of the operation display unit (37). The washing machine transmitter-receiver (38) is disposed in the other of the left side and the right side of the operation display unit (37) such that the washing machine transmitter-receiver (38) can be located opposite to the power-on switch.

FIG. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a washing machine which washes clothes inserted into a washing and spin-drying tub of the washing machine, and a washing machine control system for controlling the washing machine.

BACKGROUND ART

[0002] As a control system for a washing machine which washes clothes inserted into a washing and spin-drying tub of the washing machine, there has been proposed such a system which controls a series of steps including washing, rinsing, and spin-drying under a program implemented by a controller of the system (for example, see PTL 1).

[0003] FIG. 9 is a cross-sectional view illustrating a structure of conventional washing machine 101 as viewed from a side. FIG. 10 is a circuit block diagram of washing machine 101. FIG. 11 illustrates a structure of operation unit 102 of washing machine 101.

[0004] As can be seen from FIG. 9, washing machine 101 is provided with housing 103 having a substantially rectangular parallelepiped shape. Water receiving tub 104 having a substantially cylindrical shape is housed in housing 103, and suspended by suspending bar 105 within housing 103. Washing and spin-drying tub 106 having a substantially cylindrical shape is rotatably housed in water receiving tub 104. Agitating vane 107 is provided on a bottom of washing and spin-drying tub 106 in such a condition as to be rotatable around a shaft extending in the vertical direction.

[0005] Motor 108 for rotating agitating vane 107 is provided outside a bottom of water receiving tub 104. Motor 108 is constituted by a direct current brushless motor. Power switching mechanism 109 is provided between motor 108 and agitating vane 107. Power switching mechanism 109 reduces a speed of a driving force received from motor 108, and transmits the speed-reduced driving force to agitating vane 107 during washing. On the other hand, power switching mechanism 109 transmits the driving force received from motor 108 to agitating vane 107 at a ratio of one to one during spin-drying.

[0006] Cover body 110 which constitutes a delivery unit for water distribution is provided above water receiving tub 104. Water supply valve 111 which supplies water into washing and spin-drying tub 106 is provided above housing 103. Drain valve 112 which discharges washing water from water receiving tub 104 is further provided below water receiving tub 104.

[0007] Connector 113 is provided on a lower part of an outer wall of water receiving tub 104. Connector 113 connects with water level detector 114 for detecting a water level of water receiving tub 104. Water level detector 114 is configured to convert a water pressure at connector 113 into an electric frequency.

[0008] In addition, operation unit 102 is disposed in a front area of an upper surface of washing machine 101. Selection of modes such as operation courses and various functions is determined in accordance with an input to input unit 126 of operation unit 102 by a user. Controller 122 provided inside the front area of the upper surface of washing machine 101 allows display unit 127 of operation unit 102 to display inputted information to notify the user about the inputted information.

[0009] As illustrated in FIG. 10, motor 108 is driven by inverter circuit 115. Inverter circuit 115 includes six switching elements 116A through 116F. Each of switching elements 116A through 116F has a parallel circuit including a power transistor and a reverse-conducting diode.

[0010] Power source 117 supplies voltage to inverter circuit 115 via a direct current power source converting device constituted by diode bridge 118, choke coil 119, and smoothing capacitor 120. Power source 117 further supplies voltage to pump 160, water supply valve 111, drain valve 112, and power switching mechanism 109.

[0011] Motor 108 is provided with three position detectors 121. Position detectors 121 detect a rotation position of motor 108.

[0012] Controller 122 includes rotation controller 123. Rotation controller 123 controls driving circuit 124 based on the rotation position of motor 108 detected by position detectors 121, and the water level of water receiving tub 104 detected by water level detector 114. Driving circuit 124 drives inverter circuit 115 based on instructions from rotation controller 123.

[0013] Pump 160, water supply valve 111, drain valve 112, and power switching mechanism 109 are connected with load driver 125. Load driver 125 drives pump 160, water supply valve 111, drain valve 112, and power switching mechanism 109 based on instructions from controller 122.

[0014] Operation unit 102 includes input unit 126 to which a washing time, a number of times of rinsing, a spin-drying time and others are inputted, and display unit 127 for displaying the washing time, the number of times of rinsing, the spin-drying time and others inputted to input unit 126.

[0015] As illustrated in FIG. 11, input unit 126 includes washing time setting switch 126a for setting a washing time, rinsing frequency setting switch 126b for setting a number of times of rinsing, spin-drying time setting switch 126c for setting a spin-drying time, and drying time setting switch 126d for setting a drying time. Input unit 126 further includes start and temporary stop switch 126e, power-on switch 126f, power-off switch 126g and others.

[0016] Display unit 127 includes washing time display unit 127a, rinsing frequency display unit 127b, spin-drying time display unit 127c, drying time display unit 127d and others.

[0017] Input unit 126 includes operation course selection switch 126h for selecting a desired course from a

plurality of basic operation courses and a special operation course, and a plurality of operation course selection display units 127e each of which corresponds to the associated one of the plurality of basic operation courses and the special operation course. The special operation course is set when at least one of the washing time, the number of times of rinsing, and the spin-drying time is changed by an input to input unit 126.

[0018] Each of the plurality of operation course selection display units 127e is constituted by a light emitting diode. The basic operation courses include a "basic course", a "speedy course", and a "house-cleaning course", for example. The "basic course" is the most standardized course. In this course, the washing time is set to "nine minutes", the number of times of rinsing is set to "twice of water injection", and the spin-drying time is set to "seven minutes", for example.

[0019] The "speedy course" is a basic operation course for speedy washing. In this course, the washing time is set to "three minutes", the number of times of rinsing is set to "once of water injection", and the spin-drying time is set to "three minutes", for example.

[0020] The "house-cleaning course" is a basic operation course for washing dry-cleaning recommended clothes by using household washing machine 101. In this course, the washing time is set to "twelve minutes", the number of times of rinsing is set to "twice of water storage", and the spin-drying time is set to "forty seconds", for example.

[0021] In the special operation course, the washing time, the number of times of rinsing, and the spin-drying time may be arbitrarily set by the user. Each of operation course selection display units 127e is provided in association with the corresponding one of the "basic course", "speedy course", "house-cleaning course", and "special operation course". Each time operation course selection switch 126h is pressed, lighting of the selected one of operation course selection display units 127e shifts to the next one of operation course selection display units 127e in the order of the "basic course", "speedy course", "house-cleaning course", and "special operation course".

[0022] An operation of washing machine 101 thus constructed is now described.

[0023] When the "special operation course" is selected in accordance with a press of operation course selection switch 126h by the user, the washing time, the number of times of rinsing, and the spin-drying time specified beforehand for the "basic course" which is the most standardized course are displayed on washing time display unit 127a, rinsing frequency display unit 127b, and spin-drying time display unit 127c, respectively. Then, the user presses at least one of washing time setting switch 126a, rinsing frequency setting switch 126b, and spin-drying time setting switch 126c a desired number of times in accordance with a washing situation of the user with reference to the washing time, the number of times of rinsing, and the spin-drying time of the "basic course" displayed on washing time display unit 127a, rinsing frequency display unit 127b, and spin-drying displaying portion 127c. By this method, the user can change at least one of the washing time, the number of times of rinsing, and the spin-drying time of the "basic course", and set the special operation course.

[0024] Then, controller 122 allows driving circuit 124 and load driver 125 to execute a series of steps for washing, rinsing, and spin-drying based on the conditions of the "special operation course" set by input unit 126.

[0025] Generally speaking, the environment where washing machine 101 is placed is often insufficiently illuminated. Accordingly, an operation performed in this environment, such an operation as changing the detailed settings of the "basic course" to the settings of the "special operation course", is not easy work for the user. Particularly, this work may become extremely hard labor when the user is an old person.

Citation List

Patent Literature

[0026] PTL 1: Unexamined Japanese Patent Publication No. 2002-119788

SUMMARY OF THE INVENTION

[0027] Provided are a washing machine and a washing machine control system capable of receiving a setting of an operation course or the like of the washing machine from a remote location, and improving the easiness of operation of the washing machine and the washing machine control system.

[0028] A washing machine communicates with a terminal device via wireless communication. The washing machine includes a controller for controlling operation and communication of the washing machine, and an operation display unit disposed in an upper part of the washing machine and extended in the left-right direction, for determining a setting of an operation course and displaying the setting. The operation display unit includes a power-on switch for turning on a power source, a display unit for displaying setting contents of the operation course, and a washing machine transmitter-receiver for communicating with the terminal device. The controller receives, via the washing machine transmitter-receiver, information on the operation course transmitted from the terminal device, and displays the operation course and controls operation of the operation course based on the information on the operation course. The power-on switch is disposed in either the left side or the right side of the operation display unit. The washing machine transmitter-receiver is disposed in the other of the left side and the right side of the operation display unit such that the washing machine transmitter-receiver can be located opposite to the power-on switch.

[0029] A washing machine control system includes a terminal device, and a washing machine configured to

communicate with the terminal device via wireless communication. The washing machine includes a controller for controlling operation and communication of the washing machine, and an operation display unit disposed on an upper part of the washing machine and extended in the left-right direction, for determining a setting of an operation course and displaying the setting. The operation display unit includes a power-on switch for turning on a power source, a display unit for displaying setting contents of the operation course, and a washing machine transmitter-receiver for communicating with the terminal device. The terminal device includes a terminal transmitter-receiver for communicating with the washing machine. The controller of the washing machine receives, via the washing machine transmitter-receiver, information on the operation course transmitted from the terminal transmitter-receiver of the terminal device, and displays the operation course and controls operation of the operation course based on the information on the operation course. The power-on switch is disposed in either the left side or the right side of the operation display unit. The washing machine transmitter-receiver is disposed in the other of the left side and the right side of the operation display unit such that the washing machine transmitter-receiver can be located opposite to the power-on switch.

BRIEF DESCRIPTION OF DRAWINGS

[0030]

FIG. 1 is a perspective view illustrating a structure of a washing machine control system according to a first exemplary embodiment of the present invention.

FIG. 2 is a cross-sectional view illustrating the washing machine control system according to the first exemplary embodiment of the present invention as viewed from a side.

FIG. 3 is a circuit block diagram of the washing machine control system according to the first exemplary embodiment of the present invention.

FIG. 4 illustrates an operation display unit of a washing machine of the washing machine control system according to the first exemplary embodiment of the present invention.

FIG. 5 illustrates a normal waveform of power source voltage, and a noise-superimposed waveform of power source voltage according to the first exemplary embodiment of the present invention.

FIG. 6A illustrates a terminal operation unit of a terminal device of the washing machine control system according to the first exemplary embodiment of the present invention.

FIG. 6B illustrates the terminal operation unit of the terminal device of the washing machine control system according to the first exemplary embodiment of the present invention, describing procedures for transferring setting contents of a net course of the terminal device.

FIG. 7 is a flowchart showing an operation of a washing machine control system according to the first exemplary embodiment of the present invention.

FIG. 8 is a perspective view of a front-loading-type washing machine according to a second exemplary embodiment of the present invention.

FIG. 9 is a cross-sectional view of a structure of a conventional washing machine as viewed from a side.

FIG. 10 is a circuit block diagram of the conventional washing machine.

FIG. 11 illustrates a structure of an operation unit of the conventional washing machine.

DESCRIPTION OF EMBODIMENTS

[0031] Exemplary embodiments according to the present invention are hereinafter described with reference to the drawings. It is intended that the present invention is not limited to the embodiments described herein.

FIRST EXEMPLARY EMBODIMENT

[0032] FIG. 1 is a perspective view illustrating a structure of washing machine control system 50 according to a first exemplary embodiment of the present invention. FIG. 2 is a cross-sectional view of washing machine 29 of washing machine control system 50 as viewed from a side. FIG. 3 is a circuit block diagram of washing machine control system 50.

[0033] As illustrated in FIGS. 1 and 2, washing machine 29 and terminal device 28 are connected via wireless communication. A user operates input unit 26 provided on operation display unit 37 of washing machine 29 to control washing machine 29 while checking the setting contents shown on display unit 27. The user also operates terminal device 28 to control washing machine 29. For allowing this control, terminal device 28 is provided with terminal transmitter-receiver 33 for exchanging information with washing machine 29. On the other hand, operation display unit 37 of washing machine 29 is provided with washing machine transmitter-receiver 38 for exchanging information with terminal device 28.

[0034] As illustrated in FIGS. 1 and 2, washing machine 29 includes housing 3 having a substantially rectangular parallelepiped shape. Water receiving tub 4 having a substantially cylindrical shape is housed in housing 3, and suspended by suspending bar 5. Washing and spin-drying tub 6 having a substantially cylindrical shape is rotatably housed in water receiving tub 4. Agitating vane 7 is provided on a bottom of washing and spin-drying tub 6 in such a condition as to be rotatable around a shaft extending in the vertical direction.

[0035] Motor 8 for rotating agitating vane 7 is provided outside a bottom of water receiving tub 4. Motor 8 is constituted by a direct current brushless motor. Power switching mechanism 9 is provided between motor 8 and

agitating vane 7. Power switching mechanism 9 reduces a speed of a driving force received from motor 8, and transmits the speed-reduced driving force to agitating vane 7 during washing. On the other hand, power switching mechanism 9 transmits the driving force received from motor 8 to agitating vane 7 at a ratio of one to one during spin-drying.

[0036] Cover body 10 which constitutes a delivery unit for water distribution is provided above water receiving tub 4. Water supply valve 11 which supplies water into washing and spin-drying tub 6 is provided above housing 3. Drain valve 12 which discharges washing water from water receiving tub 4 is provided below water receiving tub 4.

[0037] Connector 13 is provided on a lower part of an outer wall of water receiving tub 4. Connector 13 connects with water level detector 14 for detecting a water level of water receiving tub 4. Water level detector 14 is configured to convert a water pressure at connector 13 into an electric frequency.

[0038] Selection of modes such as operation courses and various functions is determined in accordance with an input to input unit 26 by a user. The inputted information is displayed on display unit 27, and notified to the user.

[0039] Operation display unit 37 is disposed in a front area of an upper surface of washing machine 29 and extended in the left-right direction. Operation display unit 37 is provided on an inclined surface located in the front area of the upper surface of washing machine 29. Controller 39 which controls washing machine 29 is disposed inside the front area of the upper surface of washing machine 29. According to the example shown in FIG. 1, terminal transmitter-receiver 33 is projected from terminal device 28. However, terminal transmitter-receiver 33 is not required to have this shape, but may be housed in terminal device 28 without projection.

[0040] As illustrated in FIG. 3, motor 8 of washing machine 29 is driven by inverter circuit 15. Inverter circuit 15 includes six switching elements 16A through 16F. Each of switching elements 16A through 16F has a parallel circuit including a power transistor and a reverse-conducting diode.

[0041] Power source 17 supplies voltage to inverter circuit 15 via a direct current power source converting device constituted by diode bridge 18, choke coil 19, and smoothing capacitor 20. Power source 17 further supplies voltage to pump 60, water supply valve 11, drain valve 12, and power switching mechanism 9.

[0042] Motor 8 is provided with three position detectors 21. Position detectors 21 detect a rotation position of motor 8.

[0043] Controller 39 includes rotation controller 23. Rotation controller 23 controls driving circuit 24 based on the rotation position of motor 8 detected by position detectors 21, and the water level of water receiving tub 4 detected by water level detector 14. Driving circuit 24 drives inverter circuit 15 based on instructions from rotation controller 23.

[0044] Pump 60, water supply valve 11, drain valve 12, and power switching mechanism 9 are connected with load driver 25. Load driver 25 drives pump 60, water supply valve 11, drain valve 12, and power switching mechanism 9 based on instructions from controller 39.

[0045] Operation display unit 37 includes input unit 26 to which a washing time, a number of times of rinsing, a spin-drying time and others are inputted, and display unit 27 for displaying the washing time, the number of times of rinsing, the spin-drying time and others inputted to input unit 26.

[0046] As illustrated in FIG. 3, terminal device 28 includes terminal operation unit 30. Terminal operation unit 30 includes net course setting unit 31 and transfer start button 32.

[0047] Net course setting unit 31 sets contents of a net course executed by washing machine 29 in accordance with a change of contents of at least one of a series of steps constituted by washing, rinsing, and spin-drying determined for a basic operation course.

[0048] Terminal transmitter-receiver 33 obtains information representing the contents of the net course set by net course setting unit 31, and transmits the information to washing machine 29 via wireless communication. The wireless communication system used for this transmission may be a communication system of NFC (Near Field Communication) or like systems, for example, employed for communication of cellular phones or others in recent years. NFC system contains a power source for supplying voltage to terminal operation unit 30 and terminal transmitter-receiver 33, and supplies power by utilizing energy generated during transmission. Alternatively, the wireless communication system may be a system which uses a battery as power source.

[0049] Net course setting unit 31 includes terminal display unit 34 and terminal input unit 35. Terminal display unit 34 displays contents of the respective steps of washing, rinsing, and spin-drying set as the contents of the net course. The user may change the setting contents by operating terminal input unit 35. Operation condition determining unit 36 determines the operation condition of washing machine 29 based on data received by terminal transmitter-receiver 33.

[0050] Terminal operation unit 30 is constituted by a touch panel, and configured to contain net course setting unit 31 and transfer start button 32. Terminal device 28 may be a cellular phone. Terminal operation unit 30 will be detailed later (see FIGS. 6A and 6B).

[0051] Washing machine 29 includes controller 39. Controller 39 has memory 40. Memory 40 stores information representing the contents of the net course and received by washing machine transmitter-receiver 38. Controller 39 controls a series of steps of washing, rinsing, and spin-drying under a program based on the information representing the contents of the net course, and received by washing machine transmitter-receiver 38 and stored in memory 40.

[0052] FIG. 4 illustrates operation display unit 37 of washing machine 29 included in washing machine control system 50 according to the first exemplary embodiment of the present invention.

[0053] As illustrated in FIG. 4, input unit 26 of operation display unit 37 includes washing time setting switch 26a for setting a washing time, rinsing frequency setting switch 26b for setting a number of times of rinsing, and spin-drying time setting switch 26c for setting a spin-drying time. Input unit 26 further includes drying time setting switch 26d for setting a drying time, start and temporary stop switch 26e, power-on switch 26f, power-off switch 26g and others. Input unit 26 still further includes existing course selection switch 26i.

[0054] Existing course selection switch 26i is a switch for selecting one of the pre-established courses of washing machine 29. Start and temporary stop switch 26e is a switch for instructing start of operation. Power-on switch 26f and power-off switch 26g are switches for turning on and off washing machine 29, respectively.

[0055] When the pre-established course is selected by existing course selection switch 26i, at least one of the washing time, the number of times of rinsing, and the spin-drying time of the course may be changed by a press of the corresponding one of washing time setting switch 26a, rinsing frequency setting switch 26b, and spin-drying time setting switch 26c for operation under the changed settings.

[0056] Display unit 27 includes washing time display unit 27a, rinsing frequency display unit 27b, spin-drying time display unit 27c, drying time display unit 27d and others. Display unit 27 further includes net course display unit 27f which lights when the net course is selected by terminal device 28.

[0057] Display unit 27 further includes a plurality of operation course selection display units 27e each of which corresponds to the associated one of a plurality of basic operation courses and a special operation course. The special operation course is set when at least one of the washing time, the number of times of rinsing, and the spin-drying time is changed by an input to input unit 26.

[0058] Each of the plurality of operation course selection display units 27e is constituted by a light emitting diode. The basic operation courses include a "basic course", a "speedy course", and a "house-cleaning course", for example. The "basic course" is the most standardized course. In this course, the washing time is set to "nine minutes", the number of times of rinsing is set to "twice of water injection", and the spin-drying time is set to "seven minutes", for example.

[0059] The "speedy course" is a basic operation course for speedy washing. In this course, the washing time is set to "three minutes", the number of times of rinsing is set to "once of water injection", and the spin-drying time is set to "three minutes", for example.

[0060] The "house-cleaning course" is a basic operation course for washing dry-cleaning recommended clothes by using household washing machine 29. In this course, the washing time is set to "twelve minutes", the number of times of rinsing is set to "twice of water storage", and the spin-drying time is set to "forty seconds", for example.

[0061] In the special operation course, the washing time, the number of times of rinsing, and the spin-drying time may be arbitrarily set by the user. Each of operation course selection display units 27e is provided in association with the corresponding one of the "basic course", "speedy course", "house-cleaning course", and "special operation course".

[0062] Operation display unit 37 further includes washing machine transmitter-receiver 38. When the user brings terminal device 28 near washing machine transmitter-receiver 38 after the input and set of the contents of the net course to terminal device 28, information is transmitted from terminal transmitter-receiver 33 provided on terminal device 28 and inputted to washing machine 29. Washing machine transmitter-receiver 38 is disposed on the left side with respect to a center of operation display unit 37 in the transverse direction such that washing machine transmitter-receiver 38 is disposed opposite to power-on switch 26f located on the right side with respect to the center of operation display unit 37.

[0063] The reason why washing machine transmitter-receiver 38 of operation display unit 37 is disposed on the left side with respect to the center is herein described. Power-on switch 26f provided on operation display unit 37 is connected with a power source line (for example, commercial power source having a power source voltage of 100 V). This power source line may be subjected to noise generation when connected with another electric device. At the time of noise generation, noise components are superimposed on the power source voltage as illustrated in the lower part of FIG. 5, for example.

[0064] FIG. 5 shows a normal waveform of the power source voltage, and a noise-superimposed waveform of the power source voltage according to the first exemplary embodiment of the present invention.

[0065] During communication by washing machine transmitter-receiver 38, it is assumed that the communication is influenced by the superimposed noise components, a magnetic field generated by flow of main current, and other conditions.

[0066] On the other hand, switches for tuning on and off the power source, including power-on switch 26f, are often disposed on the right side such that operation can be easily performed by the right hand corresponding to the dominant hand for many users. Moreover, in view of safety, switches requiring rapid actions are given priority in the positioning on the right side.

[0067] For example, supposing that the user whose dominant hand is the right hand uses a cellular phone as terminal device 28, the user inputs the settings of washing machine 29 by using the right hand corresponding to the dominant hand while carrying the cellular phone by the left hand as the hand opposite to the dominant hand.

[0068] At the time of transmission of the operation con-

ditions inputted to terminal device 28 for transfer of the operation conditions from terminal device 28 to washing machine transmitter-receiver 38 of washing machine 29, the user brings terminal device 28 near the vicinity of washing machine transmitter-receiver 38. This action is carried out by using the left hand of the user. In this case, the user can easily perform the action for bringing terminal device 28 near washing machine transmitter-receiver 38 by using the left hand when washing machine transmitter-receiver 38 is located on the left side with respect to the center. Accordingly, this structure can increase the easiness of the action performed by the user.

[0069] According to this embodiment, washing machine 29 has a width of approximately 640 mm. In general, the width ranges from about 520 mm to about 640 mm. In this embodiment, power-on switch 26f is disposed in either the left side or the right side of operation display unit 37, while washing machine transmitter-receiver 38 is disposed in the other of the left side and the right side of operation display unit 37 such that washing machine transmitter-receiver 38 can be located opposite to power-on switch 26f. According to this structure, washing machine transmitter-receiver 38 is positioned away from power-on switch 26f by 200 mm or longer. Accordingly, this structure secures a sufficient distance for preventing a condition prone to communication failure caused by noise generated from the surroundings of turn-on switch 26f.

[0070] Terminal transmitter-receiver 33 provided on terminal device 28 and washing machine transmitter-receiver 38 provided on washing machine 29 can transmit and receive information to and from each other by using NFC, for example.

[0071] FIG. 6A illustrates terminal operation unit 30 of terminal device 28 included in washing machine control system 50 according to the first exemplary embodiment of the present invention. FIG. 6B illustrates terminal operation unit 30, describing procedures for transferring setting contents of the net course of terminal device 28.

[0072] As illustrated in FIGS. 6A and 6B, the user can set a washing time, a number of times of rinsing, and a spin-drying time of the net course by pressing power source button 61 on terminal operation unit 30 of terminal device 28 and then pressing switching buttons 35a through 35c of terminal input unit 35 provided on net course setting unit 31. The user can check the setting contents on terminal display unit 34.

[0073] After completion of the setting, the user can transmit the setting contents to washing machine 29 by pressing transfer start button 32. The function of transfer start button 32 will be described later with reference to a flowchart shown in FIG. 7. Terminal device 28 performs the foregoing operation by starting and implementing dedicated application, in addition to the function as a cellular phone.

[0074] The operation and effect of washing machine control system 50 thus constructed are hereinafter described.

[0075] FIG. 7 is a flowchart showing the operation of washing machine control system 50 according to the first exemplary embodiment of the present invention.

[0076] Referring to FIG. 7, when the user presses power source button 61 provided on terminal operation unit 30 of terminal device 28, the setting contents of the net course are displayed on terminal display unit 34 provided on net course setting unit 31 as illustrated in FIG. 6A (S41).

[0077] Then, it is determined whether any one of the washing time, the number of times of rinsing, and the spin-drying time is changed from the initial settings of the setting contents of the net course (S42).

[0078] Step S43 corresponds to the case when the washing time is changed. According to the example of FIG. 6A, the washing time set to "six minutes" is changed to "nine minutes" in accordance with a touch of switching button 35a on the touch panel corresponding to terminal input unit 35 by the user.

[0079] Step S44 corresponds to the case when the number of times of rinsing is changed. According to the example of FIG. 6A, the number of times of rinsing set to "once" is changed to "twice" in accordance with a touch of switching button 35b on the touch panel corresponding to terminal input unit 35 by the user.

[0080] Step S45 corresponds to the case when the spin-drying time is changed. According to the example of FIG. 6A, the spin-drying time set to "three minutes" is changed to "seven minutes" in accordance with a touch of switching button 35c on the touch panel corresponding to terminal input unit 35 by the user.

[0081] At this time, the power source of washing machine 29 is in the "OFF" condition (S46). In this condition, the power source is cut off, and therefore washing machine 29 is not in the state where reception of information is allowed (information receivable condition). Accordingly, transfer start button 32 is not displayed as illustrated in FIG. 6A.

[0082] When the user presses power-on switch 26f of washing machine 29, the power source of washing machine 29 comes into the "ON" condition (S47). Washing machine 29 allows washing machine transmitter-receiver 38 to transmit power source ON data (data notifying about power-on condition) to terminal device 28 (S48).

[0083] Terminal device 28 receives the power source ON data, and recognizes that the power of washing machine 29 has been turned on by using operation condition determining unit 36 (S49). Terminal device 28 recognizes that washing machine 29 comes into information receivable condition. As a result, terminal device 28 displays transfer start button 32 on terminal operation unit 30 as illustrated in FIG. 6B (S50).

[0084] After the user presses transfer start button 32 (S51), the user brings terminal device 28 near washing machine transmitter-receiver 38 in the case of transmission by NFC (S52). As a consequence, all data on the settings of the net course is transmitted from terminal transmitter-receiver 33 to washing machine 29 (S53).

[0085] Washing machine 29 receives all the data on the settings of the net course through washing machine transmitter-receiver 38 (S54).

[0086] Then, washing machine 29 stores all the data on the settings of the net course in memory 40 (S55), and also lights up net course display unit 27f on operation display unit 37 (S56). When memory 40 is constituted by a non-volatile memory, all the data is allowed to be retained even after cutoff of the power source of washing machine 29.

[0087] When the user presses start and temporary switch 26e, washing machine 29 starts operation in accordance with sequences corresponding to the received setting contents of the net course (S57). Washing machine 29 similarly operates in accordance with sequences corresponding to the received setting contents of the net course when the user presses start button 62 provided on terminal operation unit 30 of terminal device 28.

SECOND EXEMPLARY EMBODIMENT

[0088] A second exemplary embodiment according to the present invention is hereinafter described.

[0089] FIG. 8 is a perspective view illustrating front-loading-type washing machine 129 according to the second exemplary embodiment of the present invention. Constituent elements in this embodiment have been given reference numbers similar to the reference numbers of the corresponding constituent elements described in the first exemplary embodiment. The same description about these elements is not repeated herein.

[0090] Similarly to the first exemplary embodiment, washing machine 129 and terminal device 28 are connected with each other via wireless communication. The user operates input unit 26 provided on operation display unit 37 of washing machine 129 to control washing machine 129 while checking setting contents on display unit 27. The user also operates terminal device 28 to control washing machine 129. For allowing this control, terminal device 28 is provided with terminal transmitter-receiver 33 for exchanging information with washing machine 129. On the other hand, operation display unit 37 of washing machine 129 is provided with washing machine transmitter-receiver 38 for exchanging information with terminal device 28.

[0091] Operation display unit 37 disposed in a front area of an upper surface of washing machine 129 has a shape extended in the left-right direction. Operation display unit 37 is disposed on an inclined surface positioned in the front area of the upper surface of washing machine 129. Controller 39 for controlling washing machine 129 is further disposed inside the front area of the upper surface of washing machine 129. The specific positions of operation display unit 37, the operation unit, washing machine transmitter-receiver 38 and others may be the same positions as the corresponding positions shown in FIG. 4, for example.

[0092] The specific operation of washing machine 129 is similar to the corresponding operation of washing machine 29 in the first exemplary embodiment. The detailed description of this operation is not repeated.

[0093] When the user brings terminal device 28 near washing machine transmitter-receiver 38 after the input and set of contents of the net course to terminal device 28, information is transmitted from terminal transmitter-receiver 33 provided on terminal device 28, and inputted to washing machine 129 via washing machine transmitter-receiver 38. Washing machine transmitter-receiver 38 is disposed on the left side with respect to the center of operation display unit 37 in the transverse direction such that washing machine transmitter-receiver 38 is disposed opposite to power-on switch 26f located on the right side with respect to the center of operation display unit 37.

[0094] The position of washing machine transmitter-receiver 38 on operation display unit 37 is now discussed. Similarly to the first exemplary embodiment, there occurs such a case where a large volume of noise components are superimposed on power source voltage as illustrated in the lower part of FIG. 5. In this case, it is assumed that communication is influenced by the noise components, a magnetic field generated by flow of main current, and other factors during communication.

[0095] For avoiding the effect of the noise components of the power source voltage and the effect of the magnetic field imposed on the communication, power-on switch 26f is disposed in either the left side or the right side of operation display unit 37, while washing machine transmitter-receiver 38 is disposed in the other of the left side and the right side of operation display unit 37 such that washing machine transmitter-receiver 38 can be located opposite to power-on switch 26f. According to this structure, washing machine transmitter-receiver 38 is located away from power-on switch 26f by a sufficient length. This structure secures a sufficient distance for preventing a condition prone to communication failure caused by noise generated from the surroundings of power-on switch 26f.

[0096] In addition, switches for tuning on and off the power source, including power-on switch 26f, are disposed on the right side such that operation can be easily performed by the right hand corresponding to the dominant hand for many users according to this embodiment. In view of safety, switches requiring rapid actions are given priority in the positioning on the right side.

[0097] For example, supposing that the user whose dominant hand is the right hand uses a cellular phone as terminal device 28, the user inputs the settings of washing machine 129 by using the right hand corresponding to the dominant hand while carrying the cellular phone by the left hand as the hand opposite to the dominant hand.

[0098] At the time of transmission of the settings of the operation conditions retained in terminal device 28 to washing machine transmitter-receiver 38 of washing machine 129, the user brings terminal device 28 near the vicinity of washing machine transmitter-receiver 38. This

action for bringing terminal device 28 near washing machine transmitter-receiver 38 is performed by using the left hand of the user. In this case, the user can easily perform the action for bringing terminal device 28 near washing machine transmitter-receiver 38 by using the left hand when washing machine transmitter-receiver 38 is located on the left side with respect to the center. Accordingly, this structure can increase the easiness of operation performed by the user.

[0099] As described above, the steps in the respective embodiments can be controlled by utilizing information communication between washing machine 29 or 129 and terminal device 28. Moreover, washing machine transmitter-receiver 38 of washing machine 29 or 129 is disposed on the left side with respect to the center of operation display unit 37, while power-on switch 26f is disposed in the right side of operation display unit 37. This structure allows the user to input the settings of washing machines 29 or 129 from a remote position from washing machines 29 or 129. Accordingly, this structure increases the easiness of operation, and securely achieves transmission and reception of information while avoiding effect of electromagnetic noise and the like on washing machine transmitter-receiver 38.

[0100] Furthermore, washing machine transmitter-receiver 38 is disposed on the inclined surface of operation display unit 37. This structure prevents adhesion of water to washing machine transmitter-receiver 38. Accordingly, this structure also prevents adhesion of water to terminal device 28 brought near washing machine transmitter-receiver 38 during communication, thereby avoiding communication failure.

[0101] The description has been given of washing machine control system 50 which utilizes communication between washing machine 29 or 129 and terminal device 28 brought near washing machine transmitter-receiver 38 in the respective embodiments. However, the present invention is not limited to these embodiments. For example, the present invention is applicable to a structure connected by a short-distance wireless communication technology using infrared light or radio waves.

[0102] According to the respective embodiments, the control systems for controlling washing machines 29 and 129 have been discussed. However, devices to be controlled under a program are not limited to washing machines 29 and 129. The present invention is applicable to control of other types of devices as long as these devices are controlled under a program implemented a microcomputer. Even in the case of systems for controlling other types of devices, operation and effect similar to the operation and effect of the structures for controlling washing machines 29 and 129 can be offered.

[0103] As can be understood from the foregoing description, according to washing machines 29 and 129 and washing machine control system 50 in the respective embodiments, the easiness of operation for a user increases. Besides, the transmission-reception function securely works without effect of electromagnetic noise, and therefore the easiness of handling improves without causing malfunction.

[0104] Moreover, each of washing machines 29 and 129 discussed in the respective embodiments communicates with terminal device 28 by wireless communication. Each of washing machines 29 and 129 includes controller 39 for controlling operation and communication of washing machine 29 or 129, and operation display unit 37 disposed in the upper part of washing machine 29 or 129 and extended in the left-right direction, for determining a setting of the operation course and displaying the setting. Operation display unit 37 includes power-on switch 26f for turning on the power source, display unit 27 for displaying the setting contents of the operation course, and washing machine transmitter-receiver 38 for communicating with terminal device 28. Controller 39 receives, via washing machine transmitter-receiver 38, information on the operation course transmitted from terminal device 28. Then, controller 39 displays the operation course and controls operation of the operation course based on the information on the operation course. Power-on switch 26f is disposed in either the left side or the right side of operation display unit 37, while washing machine transmitter-receiver 38 is disposed in the other of the left side and the right side of operation display unit 37 such that washing machine transmitter-receiver 38 can be located opposite to power-on switch 26f.

[0105] Each of washing machine systems 50 in the respective embodiments includes terminal device 28, and washing machine 29 or 129 configured to communicate with terminal device 28 via wireless communication. Each of washing machines 29 and 129 includes controller 39 for controlling operation and communication of washing machine 29 or 129, and operation display unit 37 disposed in the upper part of washing machine 29 or 129 and extended in the left-right direction, for determining a setting of the operation course and displaying the setting. Operation display unit 37 includes power-on switch 26f for turning on the power source, display unit 27 for displaying the setting contents of the operation course, and washing machine transmitter-receiver 38 for communicating with terminal device 28. Terminal device 28 includes terminal transmitter-receiver 33 for communicating with washing machine 29 or 129. Controller 39 of washing machine 29 or 129 receives, via washing machine transmitter-receiver 38, information on the operation course transmitted from terminal transmitter-receiver 33 of terminal device 28. Then, controller 39 displays the operation course and controls operation of the operation course based on the information of the operation course. Power-on switch 26f is disposed in either the left side or the right side of operation display unit 37, while washing machine transmitter-receiver 38 is disposed in the other of the left side and the right side of operation display unit 37 such that washing machine transmitter-receiver 38 can be located opposite to power-on switch 26f.

[0106] These structures increase the easiness of operation for a user. Besides, by the arrangement that

washing machine transmitter-receiver 38 is located by an appropriate distance away from power-on switch 26f which easily generates electromagnetic noise, these structures allow transmission and reception of signals securely transmitted without effect of electromagnetic noise or the like on washing machine transmitter-receiver 38.

[0107] Washing machine transmitter-receiver 38 is disposed on the left side with respect to the center of operation display unit 37, while power-on switch 26f is disposed on the right side with respect to the center of operation display unit 37.

[0108] This structure increases the easiness of operation for a user whose dominant hand is the right hand.

[0109] Washing machine transmitter-receiver 38 is disposed on the inclined surface of operation display unit 37.

[0110] This structure prevents adhesion of water to washing machine transmitter-receiver 38. Accordingly, this structure prevents adhesion of water to terminal device 28 brought near washing machine transmitter-receiver 38 during communication, thereby avoiding communication failure.

INDUSTRIAL APPLICABILITY

[0111] As aforementioned, the present invention can offer the particular advantage that an operation course and the like of a washing machine is allowed to be set from a remote location. Accordingly, the present invention is suited for a washing machine which washes clothes inserted into a washing and spin-drying tub, and for a washing machine control system or the like capable of controlling this type of washing machines. Furthermore, the present invention is applicable to control for other electric devices which are electronically controlled.

REFERENCE MARKS IN THE DRAWINGS

[0112]

3	housing
4	water receiving tub
5	suspending bar
6	washing and spin-drying tub
7	agitating vane
8	motor
9	power switching mechanism
10	cover body
11	water supply valve
12	drain valve
13	connector
14	water level detector
15	inverter circuit
17	power source
16A	through 16F switching element
18	diode bridge
19	choke coil
20	smoothing capacitor
21	position detector
23	rotation controller
24	driving circuit
25	load driver
26	input unit
26a	washing time setting switch
26b	rinsing frequency setting switch
26c	spin-drying time setting switch
26d	drying time setting switch
26e	start and temporary stop switch
26f	power-on switch
26g	power-off switch
26i	existing course selection switch
27	display unit
27a	washing time display unit
27b	rinsing frequency display unit
27c	spin-drying time display unit
27d	drying time display unit
27e	operation course selection display unit
27f	net course display unit
28	terminal device
29, 129	washing machine
30	terminal operation unit
31	net course setting unit
32	transfer start button
33	terminal transmitter-receiver
34	terminal display unit
35	terminal input unit
35a	through 35c switching button
36	operation condition determining unit
37	operation display unit
38	washing machine transmitter-receiver
39	controller
40	memory
50	washing machine control system
60	pump
61	power source button
62	start button

Claims

1. A washing machine configured to communicate with a terminal device via wireless communication, the washing machine comprising:

a controller for controlling operation and communication of the washing machine; and

an operation display unit disposed in an upper part of the washing machine and extended in a left-right direction, for determining a setting of an operation course and displaying the setting, wherein

the operation display unit includes a power-on switch for turning on a power source, a display unit for displaying setting contents of the operation course, and a washing machine transmitter-receiver for communicating with the terminal

device,
the controller receives, via the washing machine transmitter-receiver, information on the operation course transmitted from the terminal device, and displays the operation course and controls operation of the operation course based on the information on the operation course,
the power-on switch is disposed in either the left side or the right side of the operation display unit, and
the washing machine transmitter-receiver is disposed in the other of the left side and the right side of the operation display unit such that the washing machine transmitter-receiver can be located opposite to power-on switch.

2. The washing machine according to claim 1, wherein the washing machine transmitter-receiver is disposed on the left side with respect to a center of the operation display unit, and
the power-on switch is disposed on the right side with respect to the center of the operation display unit.

3. The washing machine according to claim 1 or 2, wherein the washing machine transmitter-receiver is disposed on an inclined surface of the operation display unit.

4. A washing machine control system, comprising:

a terminal device; and
a washing machine configured to communicate with the terminal device via wireless communication,
the washing machine including:

a controller for controlling operation and communication of the washing machine; and
an operation display unit disposed in an upper part of the washing machine and extended in a left-right direction, for determining a setting of an operation course and displaying the setting, wherein

the operation display unit includes a power-on switch for turning on a power source, a display unit for displaying setting contents of the operation course, and a washing machine transmitter-receiver for communicating with the terminal device,
the terminal device including:

terminal transmitter-receiver for communicating with the washing machine,

wherein

the controller of the washing machine receives, via the washing machine transmitter-receiver, information on the operation course transmitted from the terminal transmitter-receiver of the terminal device, and displays the operation course and controls operation of the operation course based on the information on the operation course,
the power-on switch is disposed in either the left side or the right side of the operation display unit, and
the washing machine transmitter-receiver is disposed in the other of the left side and the right side of the operation display unit such that the washing machine transmitter-receiver can be located opposite to the power-on switch.

FIG. 1

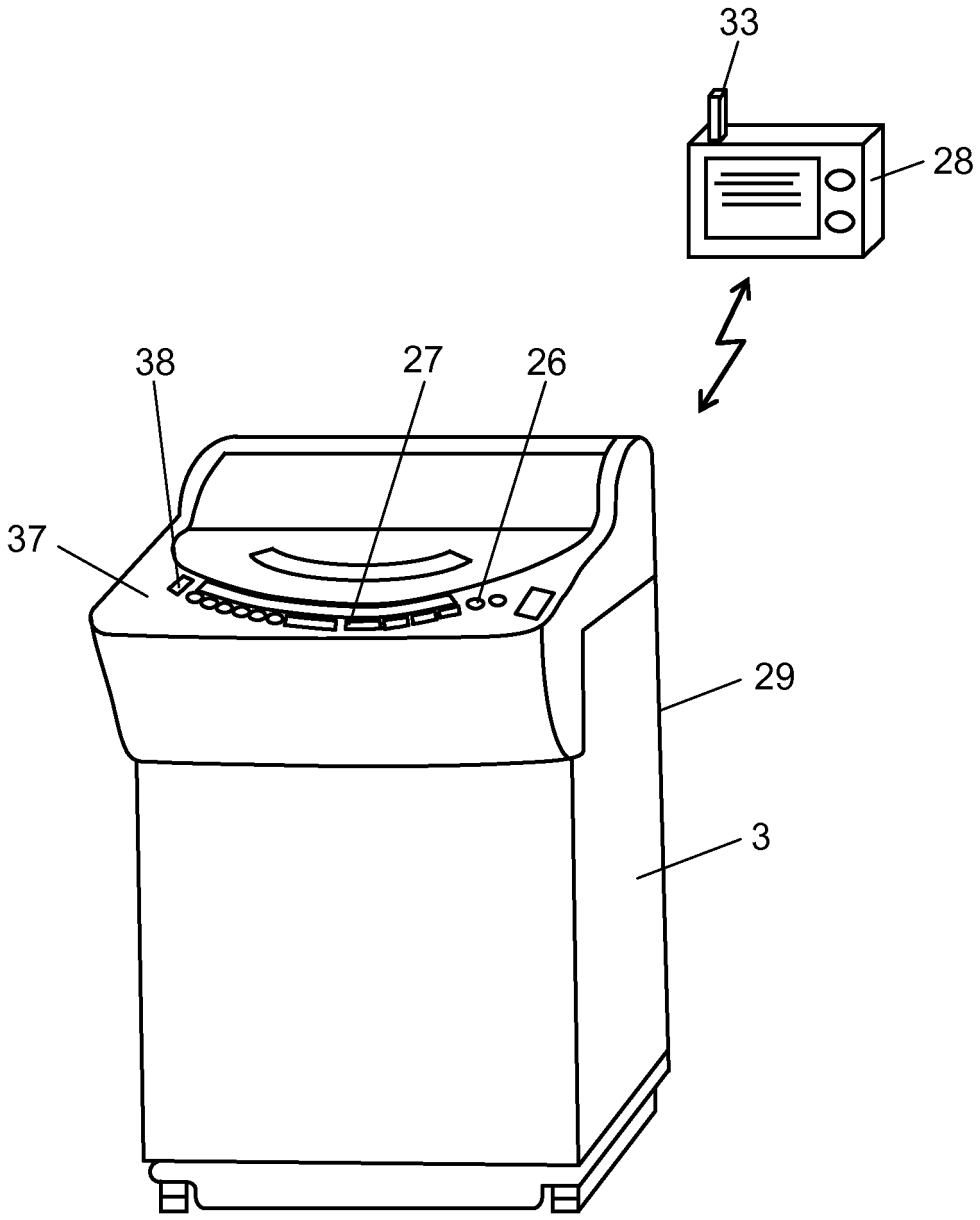


FIG. 2

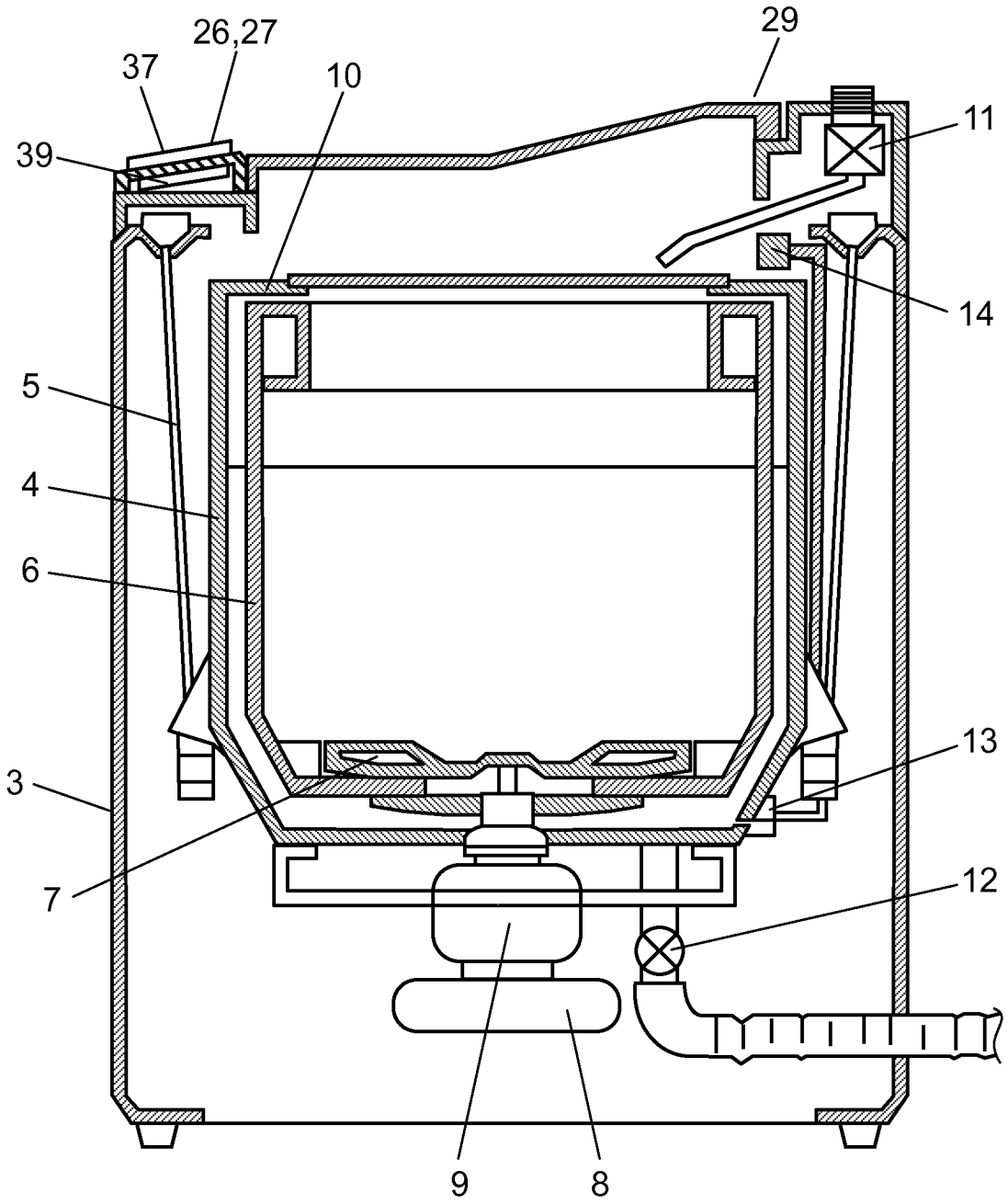


FIG. 3

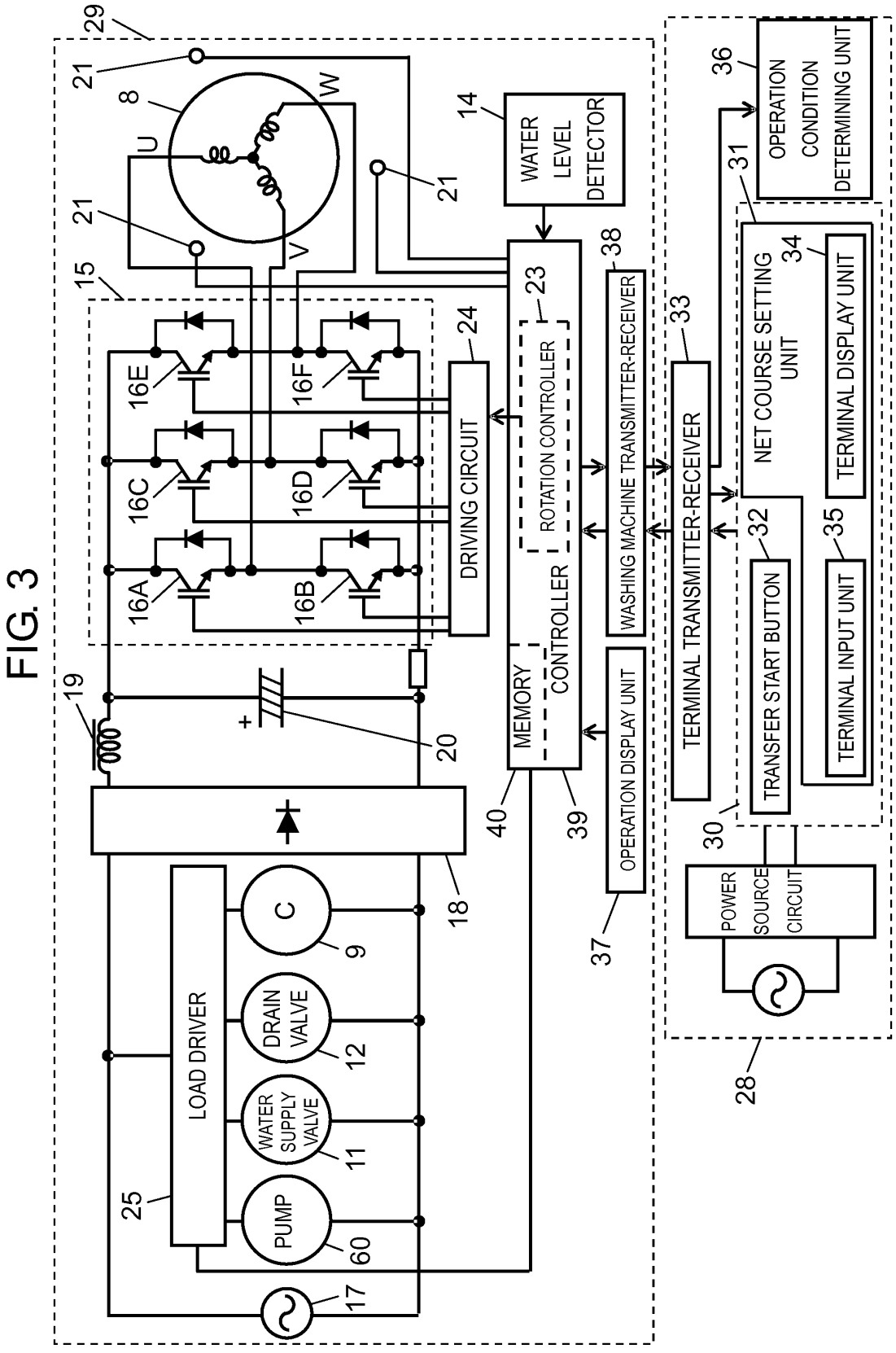

29
21
8
U
V
W
21
21
14
WATER LEVEL DETECTOR
15
16E
16F
16C
16D
16A
16B
24
DRIVING CIRCUIT
23
ROTATION CONTROLLER
CONTROLLER
MEMORY
38
WASHING MACHINE TRANSMITTER-RECEIVER
19
20
+
40
39
OPERATION DISPLAY UNIT
37
18
LOAD DRIVER
25
C
9
DRAIN VALVE
12
WATER SUPPLY VALVE
11
PUMP
60
17
33
TERMINAL TRANSMITTER-RECEIVER
36
OPERATION CONDITION DETERMINING UNIT
31
NET COURSE SETTING UNIT
34
TERMINAL DISPLAY UNIT
32
TRANSFER START BUTTON
35
TERMINAL INPUT UNIT
30
POWER SOURCE CIRCUIT
28

FIG. 4

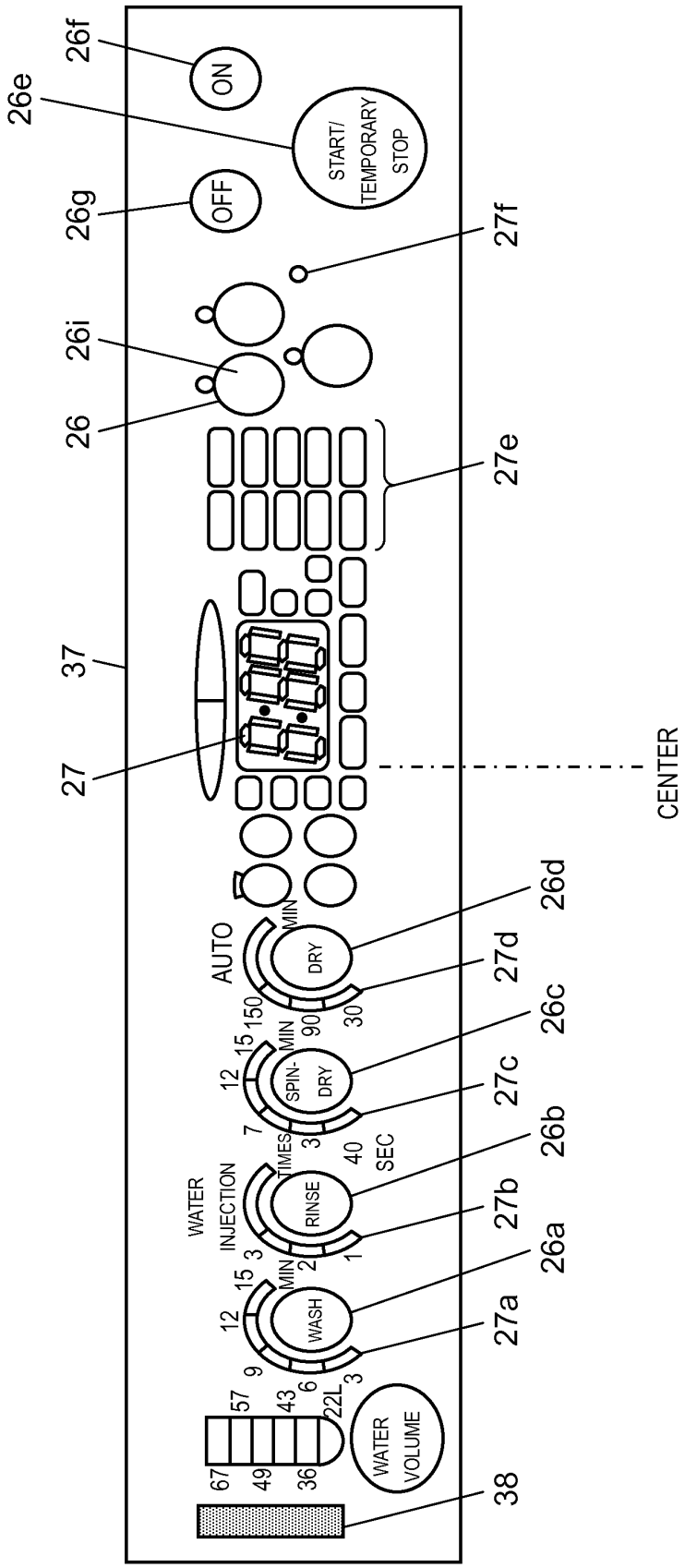

26f
ON
26e
START/
TEMPORARY
STOP
26g
OFF
27f
26i
26
27e
37
27
CENTER
AUTO
MIN
150
90
30
DRY
26d
27d
12
15
MIN
SPIN-
DRY
26c
27c
7
3
TIMES
40
SEC
WATER
INJECTION
3
2
1
RINSE
26b
27b
12
15
MIN
WASH
26a
27a
9
6
3
57
43
22L
67
49
36
WATER
VOLUME
38

FIG. 5

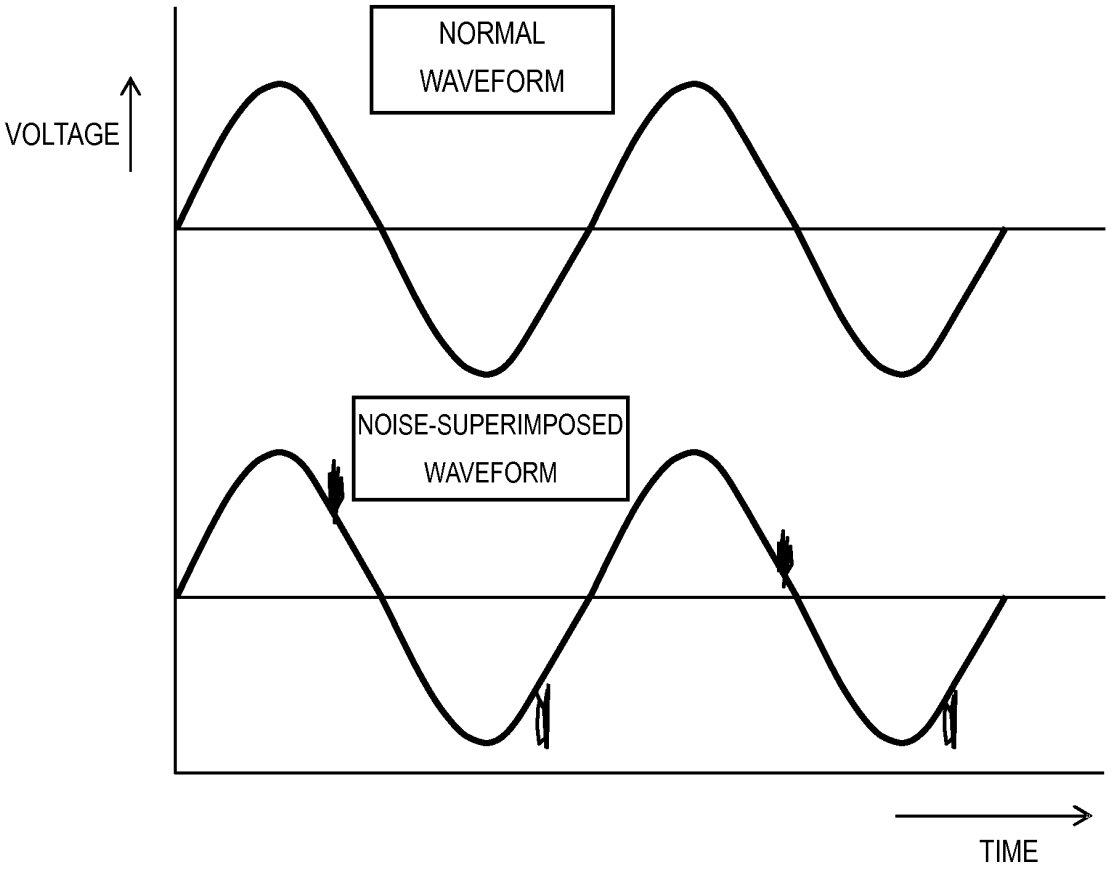

NORMAL
WAVEFORM
VOLTAGE
NOISE-SUPERIMPOSED
WAVEFORM
TIME

FIG. 6A

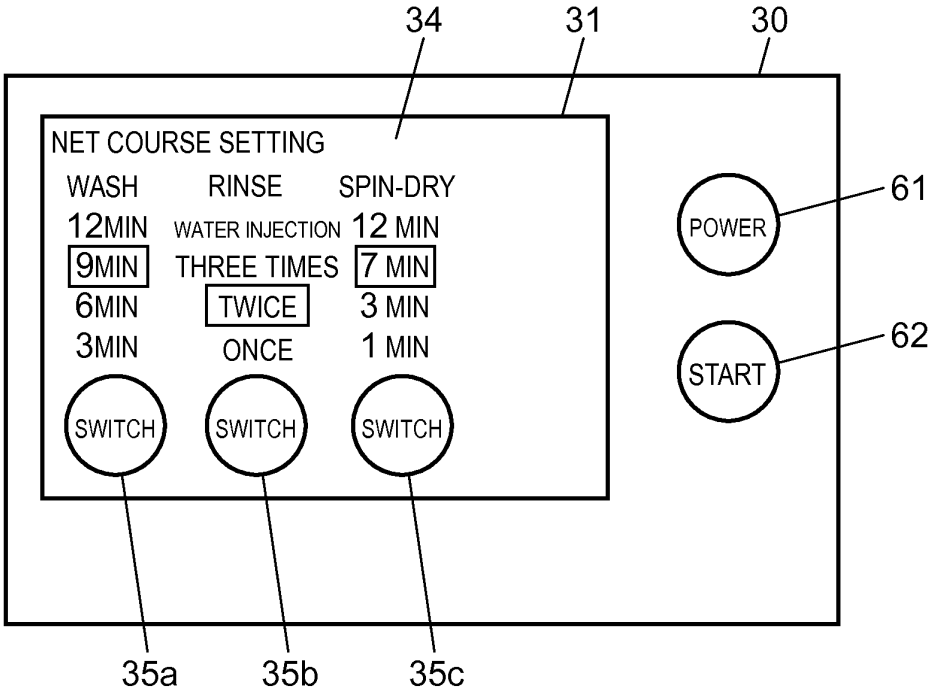

34
31
30
NET COURSE SETTING
WASH
RINSE
SPIN-DRY
12MIN
WATER INJECTION
12 MIN
9MIN
THREE TIMES
7 MIN
6MIN
TWICE
3 MIN
3MIN
ONCE
1 MIN
SWITCH
SWITCH
SWITCH
POWER
61
START
62
35a
35b
35c

FIG. 6B

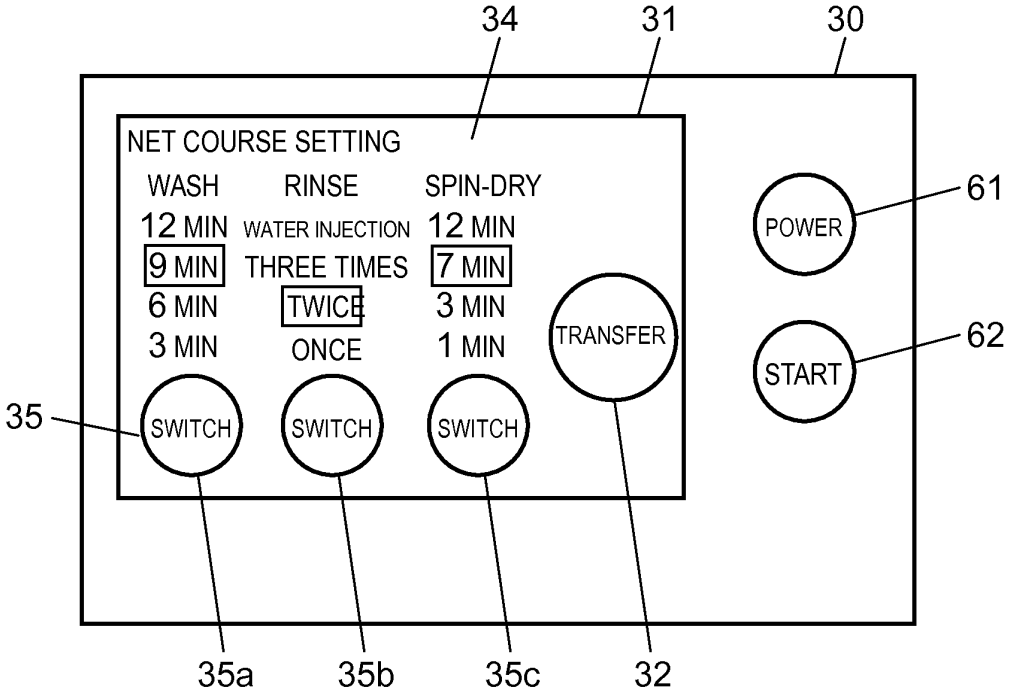

34
31
30
NET COURSE SETTING
WASH
RINSE
SPIN-DRY
12 MIN
WATER INJECTION
12 MIN
9 MIN
THREE TIMES
7 MIN
6 MIN
TWICE
3 MIN
3 MIN
ONCE
1 MIN
TRANSFER
POWER
61
START
62
35
SWITCH
SWITCH
SWITCH
35a
35b
35c
32

FIG. 7

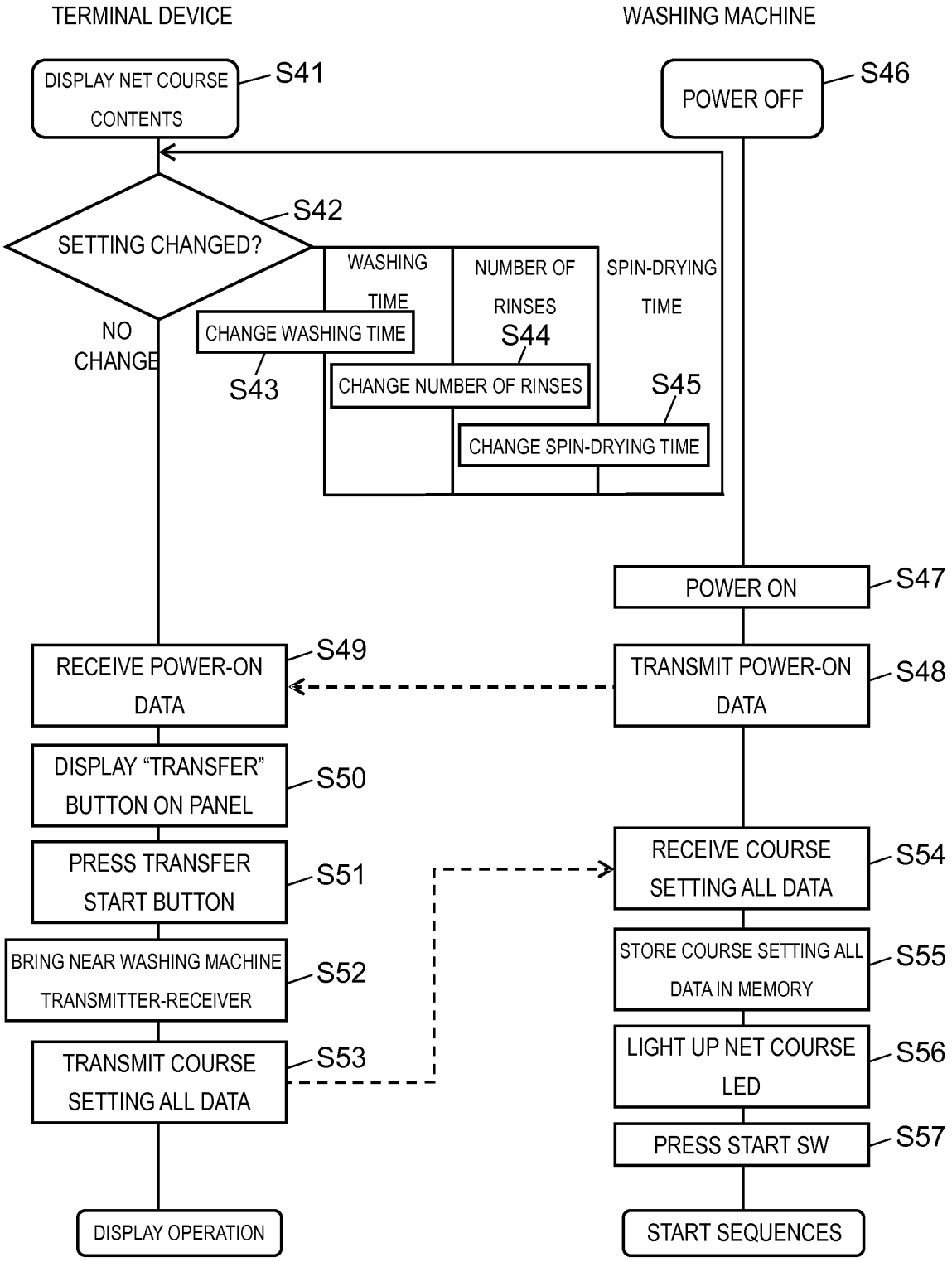

TERMINAL DEVICE
WASHING MACHINE
DISPLAY NET COURSE CONTENTS
S41
POWER OFF
S46
SETTING CHANGED?
S42
NO CHANGE
WASHING TIME
NUMBER OF RINSES
SPIN-DRYING TIME
CHANGE WASHING TIME
S43
S44
CHANGE NUMBER OF RINSES
S45
CHANGE SPIN-DRYING TIME
POWER ON
S47
RECEIVE POWER-ON DATA
S49
TRANSMIT POWER-ON DATA
S48
DISPLAY "TRANSFER" BUTTON ON PANEL
S50
PRESS TRANSFER START BUTTON
S51
RECEIVE COURSE SETTING ALL DATA
S54
BRING NEAR WASHING MACHINE TRANSMITTER-RECEIVER
S52
STORE COURSE SETTING ALL DATA IN MEMORY
S55
TRANSMIT COURSE SETTING ALL DATA
S53
LIGHT UP NET COURSE LED
S56
PRESS START SW
S57
DISPLAY OPERATION
START SEQUENCES

FIG. 8

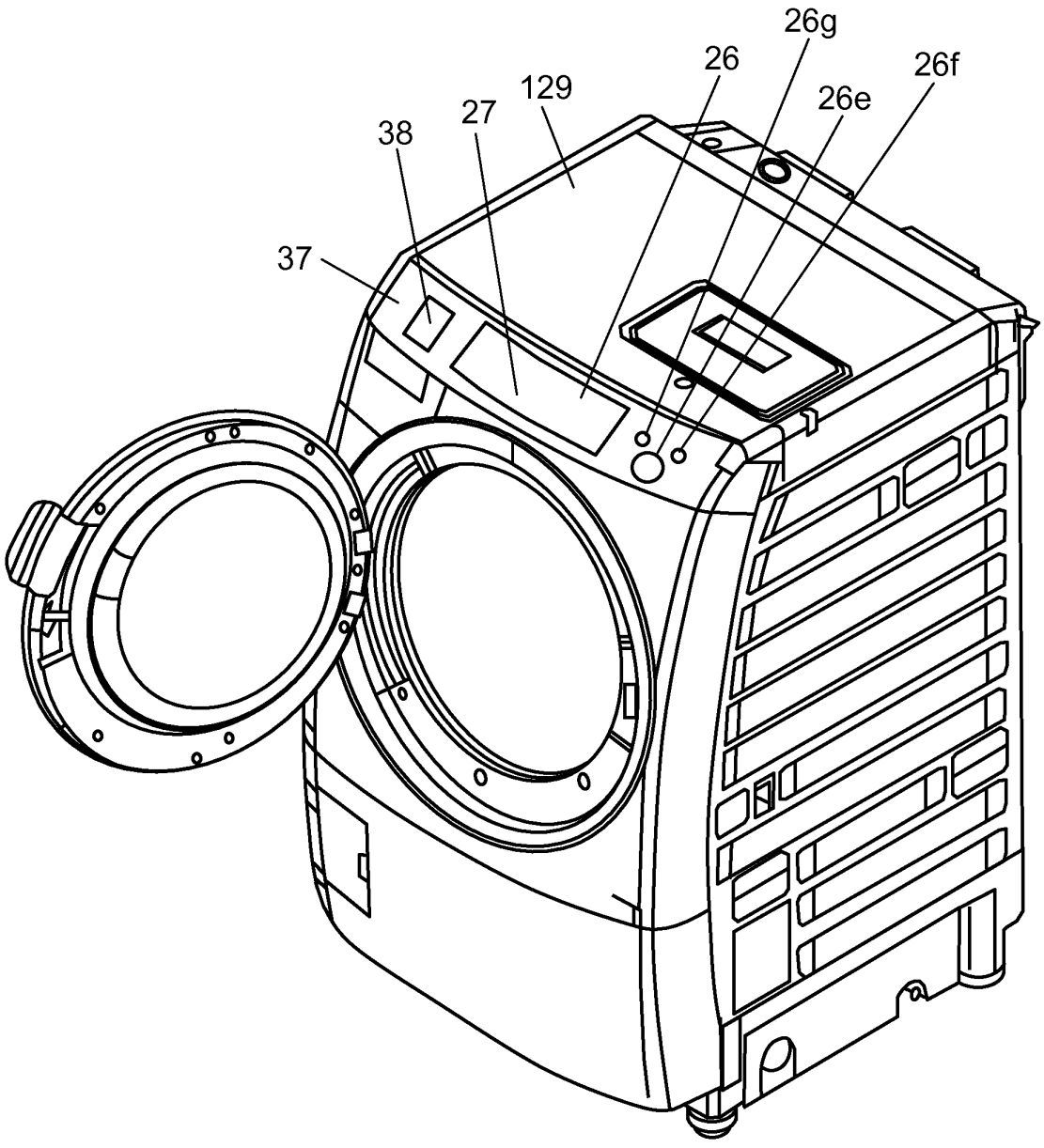
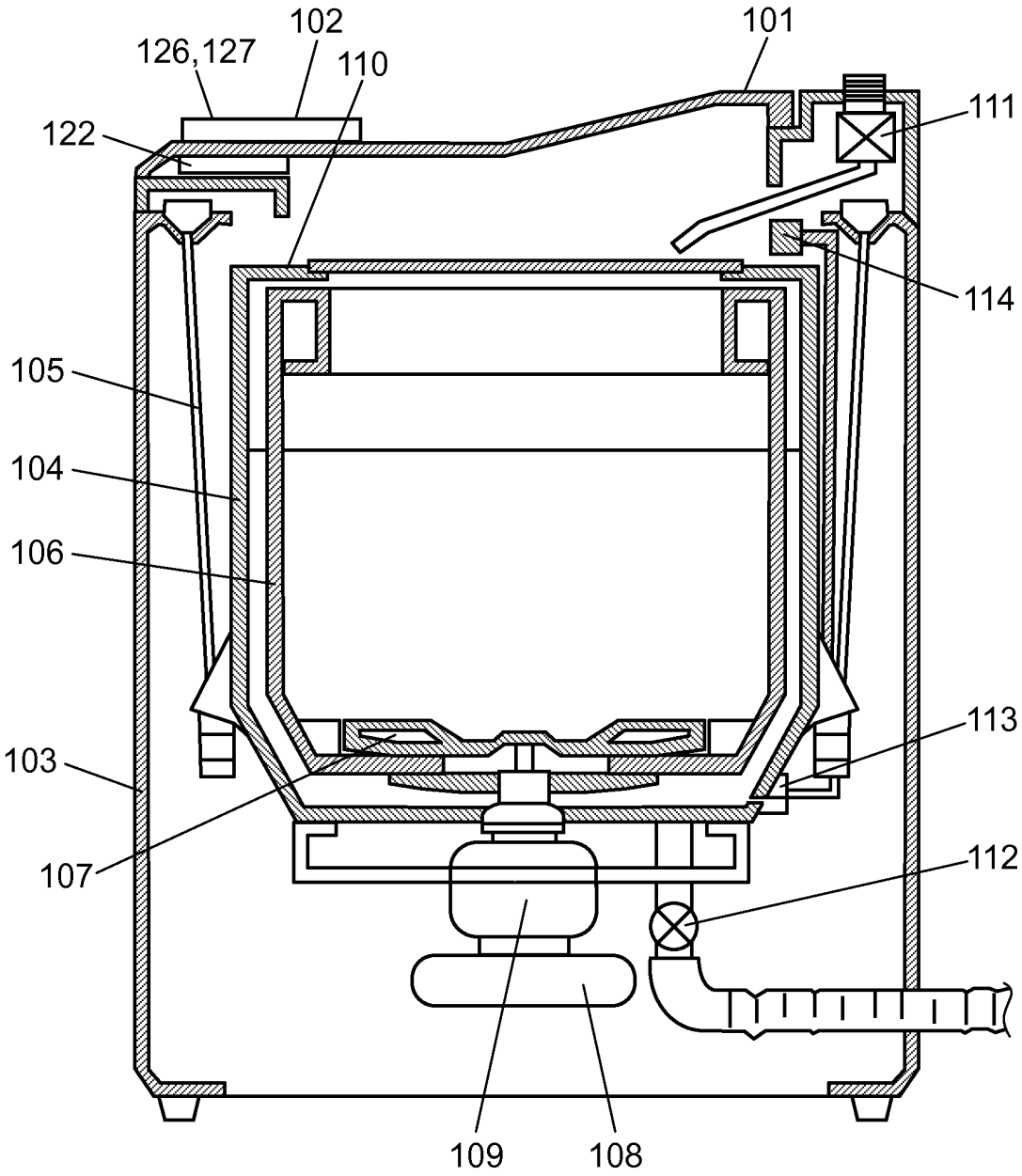


FIG. 9


102
126,127
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101
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114
105
104
106
113
103
107
112
109
108

FIG. 10

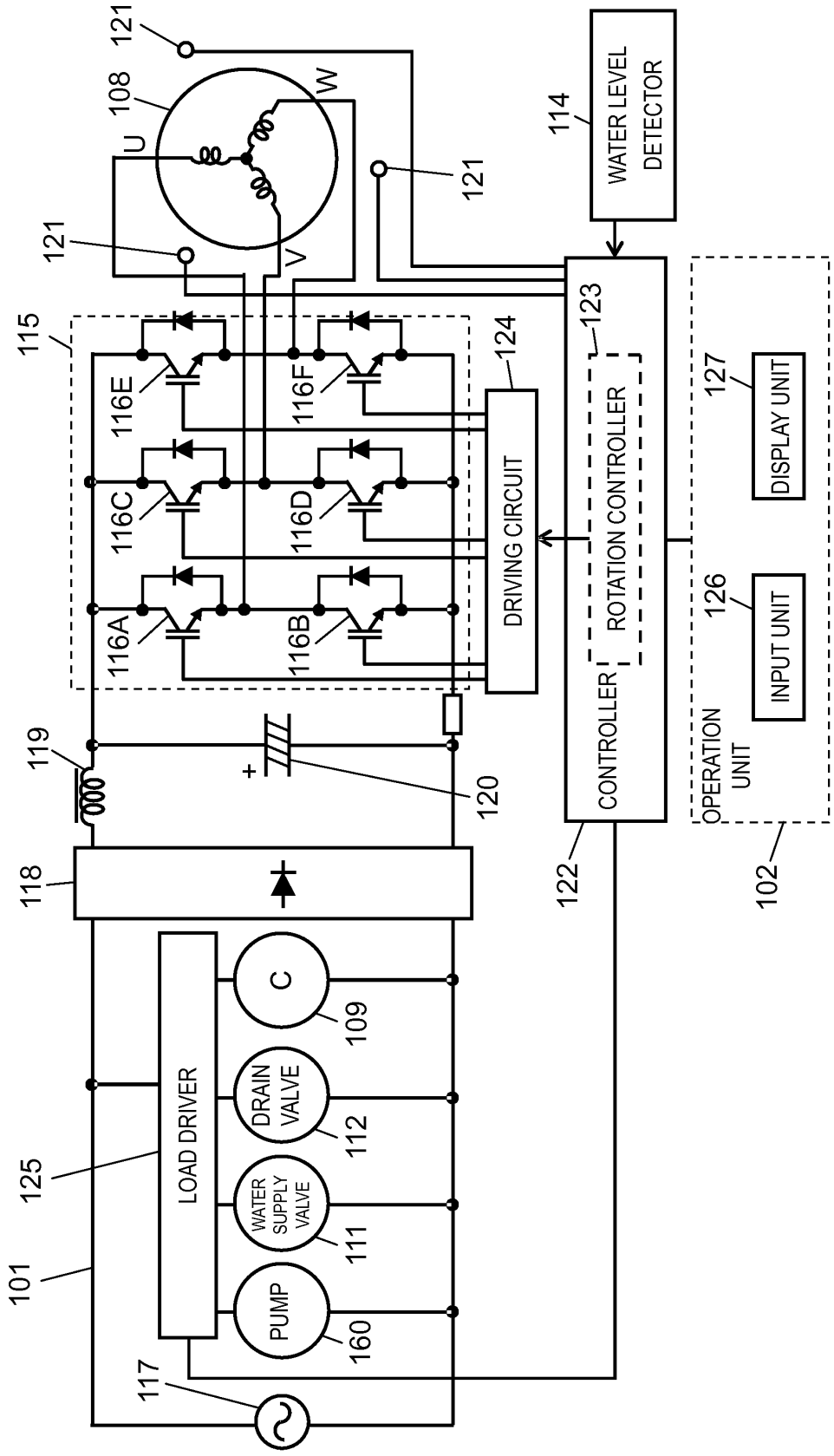
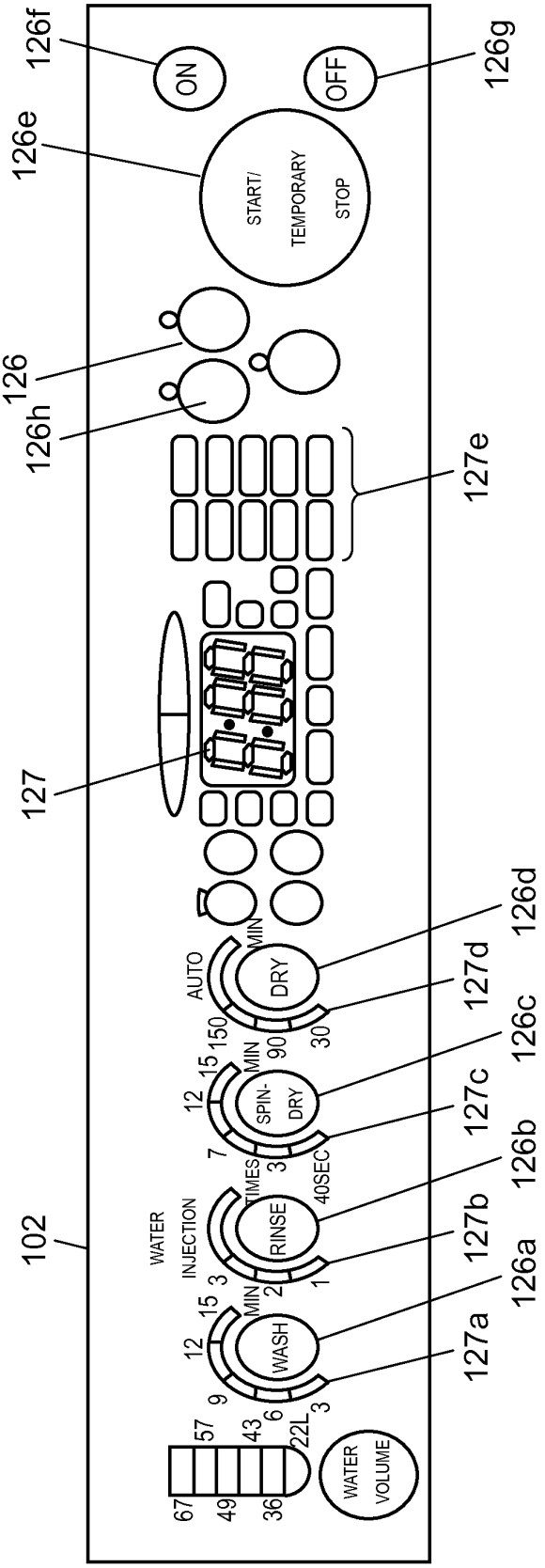

121
108
U
V
W
121
121
114
WATER LEVEL DETECTOR
115
116E
116F
116C
116D
116A
116B
124
DRIVING CIRCUIT
123
ROTATION CONTROLLER
CONTROLLER
127
DISPLAY UNIT
126
INPUT UNIT
OPERATION UNIT
119
120
118
122
102
LOAD DRIVER
C
109
DRAIN VALVE
112
WATER SUPPLY VALVE
111
PUMP
160
125
101
117

FIG. 11


126f
ON
OFF
126g
126e
START/
TEMPORARY
STOP
126
126h
127e
127
AUTO
MIN
DRY
150
90
30
126d
127d
12
15
MIN
SPIN-
DRY
126c
7
3
TIMES
40SEC
127c
WATER
INJECTION
3
MIN
2
RINSE
1
126b
127b
102
12
15
WASH
126a
9
6
3
127a
67
57
49
43
36
22L
WATER
VOLUME

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/003757

A. CLASSIFICATION OF SUBJECT MATTER
D06F33/02(2006.01)i, *D06F39/00*(2006.01)i, *D06F39/12*(2006.01)i, *H04Q9/00*(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D06F33/02, D06F39/00, D06F39/12, H04Q9/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2005-34179 A (Matsushita Electric Industrial Co., Ltd.), 10 February 2005 (10.02.2005), paragraphs [0022], [0037] to [0053]; fig. 1 to 6 (Family: none)	1-4
Y	JP 2012-105694 A (Panasonic Corp.), 07 June 2012 (07.06.2012), paragraphs [0013], [0037] to [0041]; fig. 1, 3 (Family: none)	1-4
Y	JP 5-42293 A (Toshiba Corp.), 23 February 1993 (23.02.1993), entire text; fig. 3 (Family: none)	1-4

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

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

Date of the actual completion of the international search	Date of mailing of the international search report
30 August, 2013 (30.08.13)	10 September, 2013 (10.09.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/003757

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2009-226060 A (Sanyo Electric Co., Ltd.), 08 October 2009 (08.10.2009), paragraph [0020]; fig. 2 (Family: none)	1-4
A	JP 2003-210890 A (Matsushita Electric Industrial Co., Ltd.), 29 July 2003 (29.07.2003), paragraph [0032]; fig. 5 (Family: none)	1-4
A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 29040/1992(Laid-open No. 80486/1993) (Sony Corp.), 02 November 1993 (02.11.1993), entire text; fig. 1 to 2 (Family: none)	1-4
A	JP 5-293293 A (Toshiba Corp.), 09 November 1993 (09.11.1993), entire text; fig. 7 (Family: none)	1-4

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002119788 A **[0026]**