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(71) Applicant: **Panasonic Intellectual Property Management Co., Ltd.**
Osaka-shi, Osaka 540-6207 (JP)

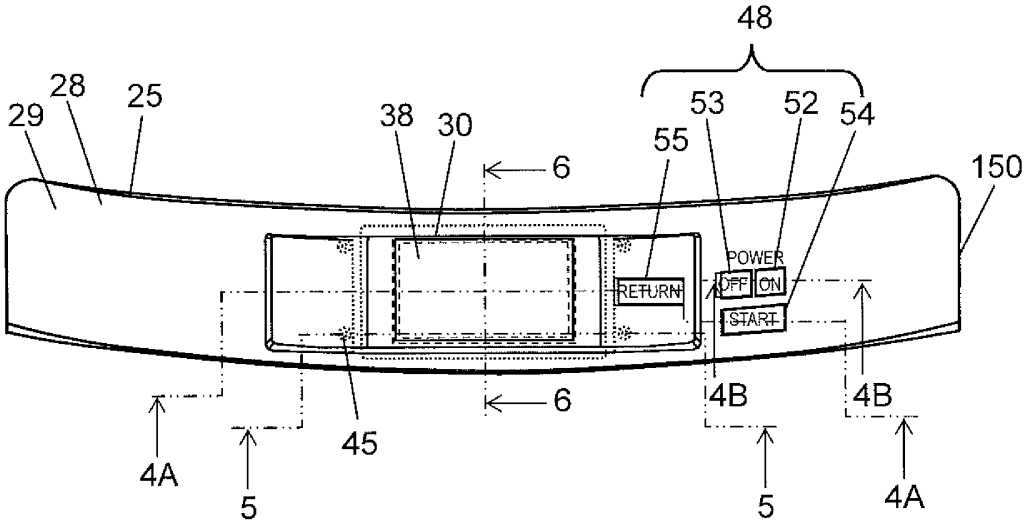
(72) Inventor: **YANAGI, Shinsuke**
Osaka-shi
Osaka 540-6207 (JP)

(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

(54) OPERATION DISPLAY DEVICE OF WASHING MACHINE, AND WASHING MACHINE

(57) There is provided an operation display device (150) of a washing machine which includes a touch panel display unit (38) that has a liquid crystal panel which displays a setting condition and a setting button of washing, rinsing, and spin-drying, that has a transparent plate which is arranged to overlap the liquid crystal panel and has a transparent electrode, and that is operated by the transparent plate being touched with a finger. In addition, the operation display device (150) includes a pressing operation button unit (48) that is disposed separately from the touch panel display unit (38), and that is operated by being pressed with a finger. A power-on button (52) for turning on power of the washing machine is included in the pressing operation button unit (48).

FIG. 3



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Description

TECHNICAL FIELD

[0001] The present invention relates to an operation display device of a washing machine having an operation unit on which a liquid crystal display is mounted, and relates to a washing machine using the same.

BACKGROUND ART

[0002] An operation display device of a washing machine in the related art will be described.

[0003] Fig. 12 is a front view of operation display device 100 of the washing machine in the related art, and Fig. 13 is a front view of control device 109 of operation display device 100.

[0004] As illustrated in Figs. 12 and 13, operation display panel 101 is configured so that panel sheet 102 formed of a sheet material is insertion-molded on an upper surface thereof. Display unit 103 and operation unit 104 are disposed in operation display panel 101. Liquid crystal panel 105 is arranged in display unit 103, and operation button unit 106 is arranged in operation unit 104, respectively.

[0005] A user can change each operation time or each setting condition for washing, rinsing, spin-drying and drying which are displayed on liquid crystal panel 105 by pressing step buttons 106a. The user can change an operation course displayed on liquid crystal panel 105 by pressing course buttons 106b. The user can switch "washing and rinsing", "washing to drying", "drying only", and "mist" by pressing washing and drying switching buttons 106c.

[0006] Power-on button 106d for turning on power, power-off button 106e for turning off power, and start button 106f for starting an operation of the washing machine are disposed in a main body of the washing machine.

[0007] Button-type electrical switch 107 disposed at a position corresponding to operation button unit 106 of operation display panel 101, LED element 108 which notifies a user that operation button unit 106 is in a pressed state, and liquid crystal panel 105 are arranged in control device 109. Control device 109 is fixed to resin case 110.

[0008] Screw hole 111 is disposed on a periphery of resin case 110, and resin case 110 is fixed to operation display panel 101 from a rear surface by a screw, thereby configuring operation display device 100 (for example, refer to PTL 1).

[0009] However, according to the above-described configuration of operation display device 100 of the washing machine in the related art, many operation buttons are present on operation display panel 101, thereby causing a user to perform complicated operations upon setting the buttons. In addition, operation unit 104 and display unit 103 are separated from each other. Consequently, there is a problem in that the user feels that it is cumbersome and has some difficulties in visibly checking when the user checks setting conditions through display unit 103.

Citation List

Patent Literature

[0010] [PTL 1] Japanese Patent Unexamined Publication No. 2008-66163

DISCLOSURE OF THE INVENTION

[0011] There are provided an operation display device of a washing machine and a washing machine which improve usability and have excellent visibility.

[0012] There is provided an operation display device of a washing machine which includes a touch panel display unit that has a liquid crystal panel which displays a setting condition and a setting button of washing, rinsing, and spin-drying, that has a transparent plate which is arranged to overlap the liquid crystal panel and has a transparent electrode, and that is operated by the transparent plate being touched with a finger. In addition, the operation display device includes a pressing operation button unit that is disposed separately from the touch panel display unit, and that is operated by being pressed with a finger, and an operation display panel that includes the touch panel display unit and the pressing operation button unit. A power-on button for turning on power of the washing machine is included in the pressing operation button unit.

[0013] There is provided an operation display device of a washing machine which includes a touch panel display unit that has a liquid crystal panel which displays a setting condition and a setting button of washing, rinsing, and spin-drying, that has a transparent plate which is arranged to overlap the liquid crystal panel and has a transparent electrode, and that is operated by the transparent plate being touched with a finger. In addition, the operation display device includes a pressing operation button unit that is disposed separately from the touch panel display unit, and that is operated by being pressed with a finger, and an operation display panel that includes the touch panel display unit and the pressing operation button unit. A power-off button for turning off power of the washing machine is included in the pressing operation button unit.

[0014] In addition, there is provided a washing machine that includes the above-described operation display device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a lateral view illustrating a cross-sectional configuration of a washing machine according to an

embodiment of the present invention.
Fig. 2 is a perspective view illustrating an overall configuration of a washing machine according to an embodiment of the present invention.
Fig. 3 is a plan view illustrating an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 4A is a view illustrating a cross-sectional configuration taken along line 4A-4A in Fig. 3.
Fig. 4B is a view illustrating a cross-sectional configuration taken along line 4B-4B in Fig. 3.
Fig. 5 is a view illustrating a cross-sectional configuration taken along line 5-5 in Fig. 3.
Fig. 6 is a view illustrating a cross-sectional configuration taken along line 6-6 in Fig. 3.
Fig. 7A is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 7B is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 7C is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 7D is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 7E is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 7F is a view illustrating an example of display contents displayed on a liquid crystal panel of an operation display device of a washing machine according to an embodiment of the present invention.
Fig. 8 is a circuit block diagram of a touch panel display unit of a washing machine according to an embodiment of the present invention.
Fig. 9 is a view illustrating a cross-sectional configuration when seen laterally from a touch panel display unit of a washing machine according to an embodiment of the present invention.
Fig. 10 is a view illustrating a detection state when a touch panel display unit of a washing machine according to an embodiment of the present invention detects a touch operation.
Fig. 11 is a view easily illustrating a detection state when the touch panel display unit detects a touch operation.
Fig. 12 is a front view of an operation display device of a washing machine in the related art.
Fig. 13 is a front view of a control device in an operation display device of a washing machine in the related art.

PREFERRED EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0016] Hereinafter, an embodiment of the present invention will be described with reference to the drawings. The present invention is not limited to the embodiment.

[0017] Fig. 1 is a lateral view illustrating a cross-sectional configuration of washing machine 200 according to the embodiment of the present invention, and Fig. 2 is a perspective view illustrating an overall configuration of washing machine 200.

[0018] As illustrated in Figs. 1 and 2, washing machine 200 has main body 12. Water tub 13 in a suspended state is arranged inside main body 12. Rotary drum 14 formed in a bottomed cylindrical shape is rotatably arranged inside water tub 13 in a state where an axial direction thereof is tilted downward from a front surface side toward a rear surface side. A direction for arranging rotary drum 14 is not limited to the above-described example. For example, rotary drum 14 may be configured to be rotatably arranged in a state where the axial direction is maintained to be a horizontal direction.

[0019] Laundry loading and unloading port 15 which leads to an opening end of rotary drum 14 is formed on the front surface side of water tub 13. Loading opening 17 is disposed on an upward tilted surface which is formed in a front portion of front frame 16 configuring a front surface of main body 12. A user opens door 18 which opens and closes loading opening 17. In this manner, the user can load and unload laundry inside rotary drum 14 through laundry loading and unloading port 15.

[0020] Since door 18 is disposed on the upward tilted surface, the user can load and unload the laundry without bending over. This allows washing machine 200 to have superior workability compared to a front-loading-type washing machine which causes the user to load and unload the laundry through an opening disposed laterally in the horizontal direction.

[0021] Many through-holes 19 leading to the inside of water tub 13 are formed on a peripheral surface of rotary drum 14. Rotary drum 14 is rotatably driven in a forward direction and a rearward direction by motor 20 attached to a rear surface side of water tub 13. Water injection pipe 21 and drain pipe 22 are connected to water tub 13 by piping. Washing water is injected into and drained from water tub 13 by controlling water injection valve 23 and drain valve 24.

[0022] Operation display panel 25 is arranged in an upper portion of front frame 16. Below operation display panel 25, detergent loading case 26 is arranged in front frame 16 so as to be drawn out forward. The user puts detergent in detergent loading case 26 prior to operation, and operates operation display panel 25 if necessary. This enables the user to set the user's desired operation conditions. In this manner, the user can start or pause the operation, and can recognize a progress of the operation.

[0023] If the user opens door 18, loads the laundry into

rotary drum 14, and starts the operation, water injection valve 23 is opened, and the washing water is injected into detergent loading case 26. The washing water flushes the detergent loaded in detergent loading case 26, and is injected into water tub 13 via water injection pipe 21 so as to reach a predetermined amount.

[0024] If the washing water is injected and reaches the predetermined amount, rotary drum 14 is rotatably driven by motor 20 and a washing step is started. In the washing step, the laundry is lifted up in a rotation direction in response to the rotation of rotary drum 14, and then is dropped. This agitating operation is repeated to perform the washing step.

[0025] After a required washing time elapses, drain valve 24 is opened, and dirty washing water is drained from drain pipe 22. Then, the washing water contained in the laundry is spin-dried by a spin-drying operation for rotating rotary drum 14 at a high speed.

[0026] Thereafter, drain valve 24 is closed, rinsing water is injected into water tub 13 through water injection pipe 21, and a rinsing step is performed. In the rinsing step, the agitating operation is also repeated for the laundry by the rotation of rotary drum 14.

[0027] Fig. 3 is a plan view illustrating operation display device 150 of washing machine 200 according to an embodiment of the present invention. Fig. 4A is a view illustrating a cross-sectional configuration taken along line 4A-4A in Fig. 3. Fig. 4B is a view illustrating a cross-sectional configuration taken along line 4B-4B in Fig. 3. Fig. 5 is a view illustrating a cross-sectional configuration taken along line 5-5 in Fig. 3. Fig. 6 is a view illustrating a cross-sectional configuration taken along line 6-6 in Fig. 3.

[0028] As illustrated in Figs. 2 to 6, operation display panel 25 is arranged between the upside of front frame 16 and top plate 27. A surface of transparent resin portion 28 is covered with panel sheet 29 which is insertion-molded to transparent resin portion 28 and which is formed of a PET film. Panel sheet 29 configures a decorative surface subjected to coloring and printing. Opening 30 which has a substantially rectangular shape is disposed in the center between transparent resin portion 28 and panel sheet 29.

[0029] Opening 30 is a region having no transparent resin and no film. On a rear surface of opening 30, transparent plate 31 configured to have transparent glass is attached to operation display panel 25 via elastic body 32. Elastic body 32 pinches an outer peripheral portion of transparent plate 31. While pressing transparent plate 31, elastic body 32 fixes transparent plate 31 to a periphery of opening 30 in transparent resin portion 28.

[0030] Transparent electrode 33 adheres to a rear surface of transparent plate 31 by double-sided transparent tape 37 which is called an optical clear adhesive tape (OCA tape). This configures touch panel display unit 38. Therefore, touch panel display unit 38 is transparent and transmits light.

[0031] On a lower side of a rear surface of touch panel display unit 38, liquid crystal panel 34 is arranged by being attached to liquid crystal attachment base 35. Main control board 36 for controlling transparent electrode 33 and liquid crystal panel 34 is attached to a surface of liquid crystal attachment base 35 which is opposite to a surface to which liquid crystal panel 34 is attached.

[0032] As described above, in operation display device 150, transparent plate 31, double-sided transparent tape 37, transparent electrode 33, liquid crystal panel 34, and main control board 36 are stacked on one another in this order. Pictures or letters displayed on liquid crystal panel 34 are visibly recognized from a surface side of operation display panel 25 via transparent plate 31, double-sided transparent tape 37, and transparent electrode 33 which configure touch panel display unit 38. A lighting device configured to have a planar shape is arranged on the rear surface side of liquid crystal panel 34. The lighting device emits light to liquid crystal panel 34. In this manner, it is possible to further improve visibility of the pictures or the letters displayed on liquid crystal panel 34.

[0033] Touch panel dedicated IC 40 which determines whether or not a user performs a touch operation by inputting a signal to and outputting a signal from touch panel display unit 38, and which transmits a determination signal to microcomputer 39, is mounted on main control board 36.

[0034] Electronic components such as liquid crystal panel 34 and main control board 36 are arranged on the rear side of transparent plate 31, thereby requiring waterproofness. Therefore, a configuration is adopted in which the outer peripheral portion of substantially rectangular transparent plate 31 is covered with frame-shaped elastic body 32, and in which liquid crystal panel 34 or main control board 36 is attached to the rear surface of opening 30 via elastic body 32.

[0035] On the periphery of upper side 41 and lower side 42 of opening 30, elastic body 32 pinches a front surface side, a rear surface side, and an end surface side of transparent plate 31 in three directions. Elastic body 32 pinching transparent plate 31 is brought into pressurizing contact with a portion between operation display panel 25 and liquid crystal attachment base 35. In this manner, it is possible to ensure the waterproofness.

[0036] On the periphery of left side 43 and right side 44 of opening 30, the rear surface side and the end surface side of transparent plate 31 are brought into contact with elastic body 32 in two directions. Elastic body 32 and transparent plate 31 are brought into pressurizing contact with a portion between operation display panel 25 and liquid crystal attachment base 35. In this manner, it is possible to ensure the waterproofness.

[0037] In the above-described example, a configuration has been described in which a waterproof structure on the periphery of left side 43 and right side 44 of opening 30 is different from a waterproof structure on the periphery of upper side 41 and lower side 42 of opening 30. However, the present invention is not limited to this example. Even if a configuration is adopted in which the

waterproof structure on the periphery of left side 43 and right side 44 of opening 30 is the same as the waterproof structure on the periphery of upper side 41 and lower side 42 of opening 30, it is possible to obtain a favorable effect.

[0038] Boss 45 is disposed at four corners of opening 30 on the rear surface of the operation display panel 25. Liquid crystal attachment base 35 and rear surface cover 46 are fastened to each other by screws 47. Rear surface cover 46 is configured to have a resin member which covers main control board 36 from the rear surface.

[0039] In a fastening state of screws 47, elastic body 32 is pressed against liquid crystal attachment base 35, and elastic body 32 is in close contact with transparent plate 31 and operation display panel 25. Therefore, the waterproofness on the periphery of opening 30 is ensured. According to this configuration, even when a user spills water or liquid detergent into opening 30 by mistake, there is no possibility that the water adheres to electronic components such as liquid crystal panel 34 and main control board 36 on the inside, thereby ensuring reliability of the components. Accordingly, it is possible to prevent failure or malfunction.

[0040] Transparent plate 31 is attached to the rear surface of opening 30 via elastic body 32. Therefore, an impact applied from the outside is softened, and thus, it is possible to prevent the impact from causing damage to the glass. For example, an impact force may be applied to transparent plate 31 when a user drops something, or when the product is dropped or overturned from a shipping state while the product in a packed state is delivered to the user's home for distribution. In this case, elastic body 32 is arranged on the outer periphery of transparent plate 31, thereby allowing a structure for softening the impact. Therefore, it is possible to prevent the damage, even if the impact is applied from the outside.

[0041] Operation display panel 25 has pressing operation button unit 48 which includes start button 54, power-on button 52, power-off button 53, and return button 55 in a state of being separated and independent from touch panel display unit 38.

[0042] Start button 54 is a button for a user to instruct washing machine 200 to start an operation after the user completes various settings for an operation course of washing machine 200. Power-on button 52 and power-off button 53 are buttons for the user to turn on and off power of washing machine 200. Return button 55 is a button for the user to instruct touch panel display unit 38 to return to a display screen which is one screen before when the user operates touch panel display unit 38.

[0043] In pressing operation button unit 48 including start button 54, power-on button 52, power-off button 53, and return button 55, each button has the same configuration.

[0044] Sub-control board 50 on which switch 49 is mounted is disposed inside operation display panel 25 by being fixed to rear surface cover 46. In addition, operation member 51 for performing a pressing operation on switch 49 is capable of being pressed from the outside of operation display panel 25. Specifically, button opening 80 is disposed in operation display panel 25, and button opening 80 is closed by panel sheet 29 which is integrally molded on a surface of operation display panel 25. This configuration can prevent water from permeating into the inside of operation display panel 25 through button opening 80.

[0045] As described above, operation member 51 is held between operation display panel 25 and rear surface cover 46. Transparent resin portion 28 is not present on pressing operation button unit 48, but only panel sheet 29 is present thereon. Accordingly, the user deforms panel sheet 29 by pressing panel sheet 29. In this manner, the user can press switch 49 via operation member 51.

[0046] This configuration enables the user to operate switch 49 by using a small operation force. If the user performs the pressing operation, an input signal of switch 49 is transmitted from sub-control board 50 to microcomputer 39 of main control board 36.

[0047] Since the panel sheet 29 prevents water from permeating the inside of operation display panel 25 through pressing operation button unit 48, waterproofness can be ensured. That is, the waterproofness can be respectively ensured in start button 54, power-on button 52, power-off button 53, and return button 55 which are separated and independent from touch panel display unit 38.

[0048] Figs. 7A to 7F are views illustrating an example of display contents displayed on liquid crystal panel 34 of operation display device 150 of washing machine 200 according to the embodiment of the present invention.

[0049] With reference to Figs. 3 and 7A to 7F, a driving operation of washing machine 200 will be described.

[0050] In Figs. 7A to 7F, the display contents of liquid crystal panel 34 are transmitted through transparent electrode 33, double-sided transparent tape 37, and transparent plate 31, and are displayed on a screen which is visible to a user. The user performs a touch operation on transparent plate 31 using the user's finger. In this manner, the user can switch over screens and change setting conditions. As described above, touch-type setting buttons are displayed on liquid crystal panel 34.

[0051] The user first presses power-on button 52 located in operation display panel 25. This allows power to be supplied to main body 12 of washing machine 200 and liquid crystal panel 34 to be lit. Then, images illustrated in Fig. 7A are displayed.

[0052] Here, the reason that power-on button 52 is configured to be separated and independent from touch panel display unit 38 as a single button is that this ensures operability and safety. If power-on button 52 is disposed in touch panel display unit 38, touch panel display unit 38 is not energized until the user operates power-on button 52. Accordingly, nothing as well as power-on button 52 is displayed on touch panel display unit 38. Therefore, it is possible to ensure the operability by disposing power-on button 52 separately and independently from touch

panel display unit 38.

[0053] An input operation in touch panel display unit 38 is performed by detecting a change in capacitance which is caused by the user's finger. Therefore, it is difficult to completely prevent malfunction. If power-on button 52 is disposed in touch panel display unit 38, when water or detergent adheres to power-on button 52 on the screen, washing machine 200 may erroneously detect the adhering as the user operating power-on button 52. Accordingly, it is considered that power-on button 52 is caused to malfunction and power of washing machine 200 is turned on.

[0054] If this malfunction occurs, there is a possibility that the power is turned on unintentionally and the operation is started. Consequently, it is difficult to ensure the safety. However, according to the present embodiment, power-on button 52 is disposed separately and independently from touch panel display unit 38. Therefore, it is possible to prevent this malfunction, and thus, it is possible to improve the safety.

[0055] Fig. 7A illustrates a first screen after the power is turned on. Touch button for washing and rinsing 56a, touch button for washing to drying 56b, and touch button for drying 56c which perform switching for washing, rinsing and drying are arranged on the screen as a setting button for selecting washing, rinsing and drying modes.

[0056] In the respective washing, rinsing and drying modes, touch button for frequent use 57a is arranged in the center of the screen so that the user can select a "frequent use" course which is especially frequently used by the user. Touch button for favorite course 57b for selecting a "favorite" course is arranged on the left side of the screen. Touch button for other courses 57c for selecting other summarized courses is arranged on the right side of the screen.

[0057] As a setting button, touch button for menu 58 which summarizes useful information content for the user in the lower portion of the screen is arranged.

[0058] After selecting washing, rinsing and drying modes, the user sets a course on the screen illustrated in Fig. 7A. In the present embodiment, description will be made on the assumption that the touch operation is performed on touch button for washing and rinsing 56a so as to select the washing and rinsing mode, that then the touch operation is performed on touch button for frequent use 57a so as to select the frequent use course, and that the display is switched over to a display illustrated in Fig. 7B.

[0059] Fig. 7B illustrates a second screen which is switched over from the first screen in Fig. 7A when the touch operation is performed on touch button for frequent use 57a. As a setting button, touch buttons which indicate the time for each step are arranged in the center of the screen in the vertical direction. Specifically, touch button for washing 59a which indicates the time for washing, touch button for rinsing 59b which indicates the number of times for rinsing, and touch button for spin-drying 59c which indicates the time for spin-drying are respectively arranged sequentially from the left side of the screen.

[0060] Touch buttons which indicate the other detailed setting conditions for the operation are arranged in the lower portion of the screen. Specifically, touch button for water level 60a which indicates how to set a water level, touch button for bath 60b which selects whether to use bath water, and touch button for reservation 60c which selects whether to perform a reservation operation are arranged as a setting button.

[0061] In the present embodiment, description will be continued on the assumption that the user performs the touch operation on touch button for washing 59a in order to change the time for washing and thus the screen is switched over to a screen illustrated in Fig. 7C.

[0062] Fig. 7C illustrates a third screen which is switched over from the second screen in Fig. 7B when the touch operation is performed on touch button for washing 59a. Slide button for washing 61 which changes the time for washing is arranged in the center of the screen as a setting button. Touch button for determination 62 for instructing determination of the time to be changed is arranged in the lower portion of the screen.

[0063] The user changes the time for washing by laterally moving slide button for washing 61, and presses touch button for determination 62, thereby determining the time for washing which the user wants to change. If the user presses touch button for determination 62, the screen is switched over to the second screen illustrated in Fig. 7B again. The second screen in Fig. 7B displays the time changed by the user as the time for washing in a portion of touch button for washing 59a.

[0064] Fig. 7D illustrates a fourth screen which is switched over from the display in Fig. 7A when the touch operation is performed on touch button for other course 57c. Touch button for night 63a, touch button for home cleaning 63b, touch button for power cleaning and deodorizing 63c, touch button for blanket 63d, touch button for elaborate finishing 63e, and touch button for tub cleaning 63f which can be used in addition to the "favorite" and "frequent use" courses displayed on the first screen are arranged on the screen as a setting button. The user presses each button so as to select a course. If the user presses each button, the screen is switched over to the second screen illustrated in Fig. 7B again.

[0065] Fig. 7E illustrates a fifth screen which is switched over from the screen in Fig. 7A when the touch operation is performed on touch button for menu 58. As illustrated in Fig. 7E, a touch button which explains to the user how to use by excerpts of contents of a manual is disposed on the screen. Specifically, touch button for simple operation guide 64a which explains how to operate, touch button for course manual 64b which explains a course manual, and touch button for care method 64c which explains a method of maintenance for washing machine 200 are arranged as a setting button. In addition, touch button for resetting 64d which summarizes the setting conditions which are basically unchanged when set once is also arranged.

[0066] By pressing return button 55 which is located in operation display panel 25, the user can return the display screen from the currently displayed screen to the operation screen which is one screen before. Return button 55 is arranged as a single button separately and independently from touch panel display unit 38. The reason is that the user can immediately operate return button 55 when the user has difficulties in the operation or when the user wants to change the display contents. For this reason, it is possible to improve the operability.

[0067] A case is assumed in which return button 55 is disposed in touch panel display unit 38. In this case, it is necessary to display a touch button for return inside all screens illustrated in Figs. 7A to 7E. Consequently, the screen display becomes complicated, thereby deteriorating the visibility and the operability. However, according to the present embodiment, since return button 55 is disposed separately and independently from touch panel display unit 38, it is possible to prevent the visibility and the operability from being deteriorated.

[0068] If the user completes the setting for the operation conditions on the first to fifth screens illustrated in Figs. 7A to 7E, the user presses start button 54 disposed in operation display panel 25, and causes washing machine 200 to start the operation. At this time, the screen is switched over to a sixth screen which is illustrated in Fig. 7F and is an operation display screen for displaying an operation state.

[0069] When the user wants to pause the operation during the course of the operation, the user presses start button 54. When the user wants to resume the operation, the user presses start button 54 again. In this manner, the user can pause and resume the operation.

[0070] Here, the reason that start button 54 is disposed as a single button separately and independently from touch panel display unit 38 is to ensure the improved operability and the safety.

[0071] If start button 54 is disposed in touch panel display unit 38, it is necessary to display a touch button for start inside the screens illustrated in Figs. 7A to 7E. Consequently, the screen display becomes complicated, thereby deteriorating the visibility and the operability. However, according to the present embodiment, since start button 54 is disposed separately and independently from touch panel display unit 38, it is possible to prevent the visibility and the operability from being deteriorated. Therefore, it is possible to improve the operability.

[0072] An input operation in touch panel display unit 38 is performed by detecting a change in capacitance which is caused by the user's finger. Therefore, it is difficult to completely prevent malfunction. If start button 54 is disposed in touch panel display unit 38, when water or detergent adheres to start button 54 on the screen, washing machine 200 may erroneously detect the adhering as if the user operates start button 54. Accordingly, it is considered that start button 54 is caused to malfunction.

[0073] If this malfunction occurs, there is a possibility that the operation is started unintentionally. Consequently, it is difficult to ensure the safety. However, according to the present embodiment, start button 54 is disposed separately and independently from touch panel display unit 38. Therefore, it is possible to prevent this malfunction, and thus, it is possible to improve the safety.

[0074] The user presses power-off button 53 disposed in operation display panel 25. In this manner, the user can certainly turn off the power of washing machine 200 at any time.

[0075] Here, power-off button 53 is disposed as a single button separately and independently from touch panel display unit 38 in order to normally complete the operation by realizing the improved operability and the ensured safety.

[0076] A case is assumed in which power-off button 53 is disposed in touch panel display unit 38. In this case, in order to enable the user to certainly turn off the power of washing machine 200 at any time, it is necessary to display power-off button 53 inside all the screens illustrated in Figs. 7A to 7E. In this case, the screen display becomes complicated, thereby deteriorating the visibility and the operability. However, according to the present embodiment, since power-off button 53 is disposed separately and independently from touch panel display unit 38, it is possible to prevent the visibility and the operability from being deteriorated. In addition, when the user is aware of an unsafe operation state, the user can immediately perform a power-off operation. Therefore, it is possible to ensure the safety.

[0077] An input operation in touch panel display unit 38 is performed by detecting a change in capacitance which is caused by the user's finger. Therefore, it is difficult to completely prevent malfunction. If power-off button 53 is disposed in touch panel display unit 38, when water or detergent adheres to power-off button 53 on the screen, washing machine 200 may erroneously detect the adhering as if the user operates power-off button 53. Accordingly, it is considered that power-off button 53 is caused to malfunction.

[0078] If this malfunction occurs, there is a possibility that the operation is stopped unintentionally before a series of setting operations is completed. However, according to the present embodiment, power-off button 53 is disposed separately and independently from touch panel display unit 38. Therefore, it is possible to prevent this malfunction, and thus, it is possible to certainly perform the operation.

[0079] Fig. 8 is a circuit block diagram illustrating touch panel display unit 38 of washing machine 200 according to the embodiment of the present invention. Fig. 9 is a view illustrating a cross-section configuration when touch panel display unit 38 is laterally viewed.

[0080] In Fig. 8, transparent electrode 33 is formed by means of vapor deposition film formation of highly conductive indium tin oxide called ITO on glass substrate 65 and through an etching process thereafter. Transparent electrode 33 has several tens of X-electrodes 66 formed in a matrix shape at intervals of approximately 5 mm to

6 mm in the vertical direction, and several tens of Y-electrodes 67 formed in a matrix shape at intervals of approximately 5 mm to 6 mm in the horizontal direction. X-electrode 66 and Y-electrode 67 are electrically connected to touch panel dedicated IC 40. Touch panel dedicated IC 40 is electrically connected to microcomputer 39 by wiring unit 68.

[0081] In Fig. 9, shield electrode 69 subjected to the vapor deposition film formation of the ITO is formed on a rear surface of transparent electrode 33. Shield electrode 69 is connected to a ground (GND) line of main control board 36 by flexible printed circuit (FPC) wire 70, thereby increasing power supply noise immunity. Accordingly, it is possible to prevent touch panel display unit 38 from malfunctioning due to switching noise input from liquid crystal panel 34 arranged below.

[0082] Transparent electrode 33 is fixedly bonded to transparent plate 31 by double-sided transparent tape 37.

[0083] Here, a magnitude of a change in capacitance is determined by the dielectric constant of a material touched by a finger. As the dielectric constant increases, the change in capacitance increases. Accordingly, it is possible to set sensitivity to be high. The high sensitivity means that it is possible to accurately and quickly recognize a position pressed by the finger. For example, erroneous detection which detects adhering of water droplets as the position being in a finger touched state, or erroneous detection influenced by external noise is less likely to occur. For example, the dielectric constant of glass is approximately "9", and the dielectric constant of an ABS resin or a PET resin is approximately "3". The change in capacitance is inversely proportional to a thickness. Accordingly, if the material of the portion touched by the finger is formed of a glass plate, the sensitivity can be equalized even if the glass plate has the thickness three times that of the ABS resin or the PET resin.

[0084] In the present embodiment, an example has been described which uses the glass substrate as transparent electrode 33. However, a configuration of using a PET resin sheet can also obtain the same advantageous effect. In addition, an example has been described in which X-electrode 66 and Y-electrode 67 are formed on one side of transparent electrode 33 in order to reduce cost. However, even when X-electrode 66 and Y-electrode 67 are separately formed on each surface of both surfaces of transparent electrode 33, the same advantageous effect can be obtained.

[0085] Referring to Figs. 8 and 9, a detection mechanism used during the touch operation will be described.

[0086] A component having very small capacitance (approximately 2 PF to 3 PF) is present between X-electrode 66 and Y-electrode 67 which are formed on transparent electrode 33. A voltage is always repeatedly applied from touch panel dedicated IC 40 to X-electrode 66 in a certain cycle.

[0087] The voltage which is applied from X-electrode 66 and passes through the component of capacitance is always output to Y-electrode 67. Y-electrode 67 returns a voltage signal to touch panel dedicated IC 40. In this manner, it is possible to always monitor a voltage change in the component of capacitance which is present in touch panel display unit 38.

[0088] If a user touches transparent plate 31, the user's finger, transparent plate 31, double-sided transparent tape 37, and transparent electrode 33 are electrically connected to one another via the capacitance, and electricity flows to the component of capacitance which is held by a person (in general, approximately 100 PF to 150 PF). Then, as a result, the electricity is detected by touch panel dedicated IC 40. The voltage is greatly changed in the component of capacitance which is present in touch panel display unit 38. This change causes touch panel dedicated IC 40 to confirm that the touch operation is performed, and touch panel dedicated IC 40 transmits a confirmation signal to microcomputer 39.

[0089] Fig. 10 is a view illustrating a detection state when touch panel display unit 38 of washing machine 200 according to the embodiment of the present invention detects the touch operation. Fig. 11 is a view easily illustrating a detection state when touch panel display unit 38 detects the touch operation.

[0090] Fig. 10 illustrates data displayed so that a personal computer can confirm a touch signal detected by touch panel dedicated IC 40. An X-axis direction represents a long side direction of transparent plate 31, a Z-axis direction represents a short side direction of transparent plate 31, and a Y-axis direction represents touch sensitivity when the touch operation is performed. Fig. 10 illustrates that as a value in the Y-axis direction increases, the sensitivity when the touch operation is performed becomes high.

[0091] In general, threshold value S for determining the touch operation is set in touch panel dedicated IC 40. Then, depending on whether or not height H of the touch signal is beyond threshold value S, it is determined whether the touch operation is present or absent.

[0092] In Fig. 11, (c) on the right side illustrates an example of the sensitivity when a finger touches transparent plate 31, that is, when the finger performs the touch operation on transparent plate 31. (a) on the left side illustrates an example of the sensitivity when water adheres to transparent plate 31. (b) in the center illustrates an example of the sensitivity when liquid detergent adheres to transparent plate 31.

[0093] As illustrated in Fig. 11, height Ha of the sensitivity of the water having low conductivity is equal to or lower than threshold value S. However, height Hb of the sensitivity of the liquid detergent having high conductivity becomes equal to or higher than threshold value S. Consequently, there is a possibility that malfunction occurs due to erroneous detection.

[0094] For example, in order to solve this problem, if threshold value S is excessively increased so that threshold value S is equal to or higher than height Hb of the sensitivity of the liquid detergent, a difference is de-

creased between height Hc of the sensitivity when the finger performs the touch operation and threshold value S. Consequently, responsiveness or detection accuracy when the finger performs the touch operation becomes poor. Thus, there is a possibility that the operability is deteriorated or the erroneous detection occurs.

[0095] (c) on the right side in Fig. 11 illustrates an example of the height of the touch sensitivity when the finger performs the touch operation. However, in this case, an area in which the finger is in contact with transparent plate 31 affects the capacitance. For this reason, a size of the finger or an instantaneous touch area when touched causes height HC of the touch sensitivity to vary. This results in deteriorated responsiveness or detection accuracy.

[0096] In order to prevent this erroneous detection, in addition to the setting of threshold value S, a process for removing those other than the finger is performed by measuring the touch area or the touch time. However, it is difficult to completely eliminate a possibility of the erroneous detection.

[0097] However, in the present embodiment, as described above, start button 54, power-on button 52, power-off button 53, and return button 55 are disposed separately and independently from touch panel display unit 38. This provides functions of operation start, power-on, power-off, and a function of returning the display screen to the screen which is one screen before, thereby causing no erroneous detection. Accordingly, it is possible to ensure the operability and the safety.

[0098] In the present embodiment, there is provided touch panel display unit 38 which can set washing machine 200 by directly touching a pattern of the switch displayed on liquid crystal panel 34 via transparent plate 31. Touch panel display unit 38 is integrally configured so that an operation section and a display section are superimposed on each other. This enables an intuitive operation. Accordingly, it is possible to improve usability and to improve visibility by changing a size of the pattern of the switch using the setting conditions. Therefore, it is possible to improve design universally.

[0099] In the present embodiment, unlike in a pressure-sensitive touch panel, whether the operation is present or absent is detected by detecting a change in capacitance. Accordingly, the touch operation is possible by only lightly touching the transparent glass plate. Therefore, even an elderly person whose finger force is weak can easily perform the touch operation.

[0100] Even when the water or the detergent adheres to touch panel display unit 38, operation buttons which closely relate to the safety, such as the power-on, power-off, and start buttons, are disposed separately and independently from touch panel display unit 38. Accordingly, it is possible to ensure the safety. The operation contents in touch panel display unit 38 are set to be contents which do not directly relate to the safety, such as time setting in setting a course.

[0101] As described above, by disposing power-on button 52 separately from touch panel display unit 38, it is possible to prevent the malfunction such as unintentional power-on. Therefore, it is possible to improve the safety.

[0102] By disposing power-off button 53 separately from touch panel display unit 38, it is possible to prevent the malfunction such as unintentional power-off and a stopped operation. Therefore, it is possible to improve the safety, and to certainly and normally complete the operation.

[0103] As described above, operation display device 150 of washing machine 200 according to the present embodiment includes touch panel display unit 38 that has liquid crystal panel 34 which displays the setting conditions and the setting buttons for washing, rinsing, and spin-drying, that has transparent plate 31 which is arranged to overlap liquid crystal panel 34 and has transparent electrode 33 on the rear surface, and that is operated by a finger touching transparent plate 31. In addition, operation display device 150 includes pressing operation button unit 48 which is disposed separately from touch panel display unit 38 and is operated by finger pressing, and includes operation display panel 25 which includes touch panel display unit 38 and pressing operation button unit 48. Power-on button 52 for turning on the power of washing machine 200 is included in pressing operation button unit 48.

[0104] According to this configuration, it is possible to configure touch panel display unit 38 which can set washing machine 200 by directly touching the pattern of the switch displayed on liquid crystal panel 34 via transparent plate 31. Touch panel display unit 38 is integrally configured so that an operation section and a display section are superimposed on each other. This enables an intuitive operation. Accordingly, it is possible to improve usability and to improve visibility by changing a size of the pattern of the switch using the setting conditions. Therefore, it is possible to improve design universally.

[0105] In order to prevent the malfunction even when the water or the detergent adheres to touch panel display unit 38, power-on button 52 is disposed separately from touch panel display unit 38. In this manner, it is possible to improve the safety by preventing the malfunction such as unintentional power-on.

[0106] Operation display device 150 of washing machine 200 according to the present embodiment includes touch panel display unit 38 that has liquid crystal panel 34 which displays the setting conditions and the setting buttons for washing, rinsing, and spin-drying, that has a transparent plate 31 which is arranged to overlap liquid crystal panel 34 and has transparent electrode 33 on the rear surface, and that is operated by a finger touching transparent plate 31. In addition, operation display device 150 includes pressing operation button unit 48 which is disposed separately from touch panel display unit 38 and is operated by finger pressing, and includes operation display panel 25 which includes touch panel display unit 38 and pressing operation button unit 48. Power-off but-

ton 53 for turning off the power of washing machine 200 is included in pressing operation button unit 48.

[0107] According to this configuration, it is possible to configure touch panel display unit 38 which can set washing machine 200 by directly touching the pattern of the switch displayed on liquid crystal panel 34 via transparent plate 31. Touch panel display unit 38 is integrally configured so that an operation section and a display section are superimposed on each other. This enables an intuitive operation. Accordingly, it is possible to improve usability and to improve visibility by changing a size of the pattern of the switch using the setting conditions. Therefore, it is possible to improve design universally.

[0108] In order to prevent the malfunction even when the water or the detergent adheres to touch panel display unit 38, power-off button 53 is disposed separately from touch panel display unit 38. In this manner, it is possible to improve the safety and to certainly and normally complete the operation by preventing the malfunction such as unintentional power-off and a stopped operation.

[0109] Transparent electrode 33 is configured to detect a change in capacitance when touched by a finger via transparent plate 31.

[0110] In this manner, it is possible to confirm whether the operation is present or absent by detecting a change in capacitance. A user does not need to firmly press the button with a strong finger force. The touch operation can be detected by only lightly touching transparent plate 31. Therefore, even a user such as an elder person whose finger force is weak can easily and certainly perform the touch operation.

[0111] Opening 30 which exposes transparent plate 31 is disposed in operation display panel 25. Elastic body 32 arranged on the periphery of transparent plate 31 is in pressurizing contact with and seals the periphery of opening 30.

[0112] In this manner, even when water or detergent adheres to transparent plate 31, it is possible to prevent the water or the detergent from permeating the inside through opening 30. The water or the detergent does not adhere to transparent electrode 33 or liquid crystal panel 34, thereby reducing failures. Therefore, it is possible to improve reliability.

[0113] Pressing operation button unit 48 has switch 49, operation member 51 which performs the pressing operation on switch 49, button opening 80 which is disposed in operation display panel 25 in order to press operation member 51, and panel sheet 29 which closes button opening 80 and is integrally molded on the surface of operation display panel 25.

[0114] According to this configuration, it is possible to prevent the water from permeating the inside of pressing operation button unit 48. The water or the detergent does not adhere to transparent electrode 33 or liquid crystal panel 34, thereby reducing failures. Therefore, it is possible to improve reliability.

[0115] Furthermore, according to the configuration of washing machine 200 including the above-described operation display device 150, it is possible to configure touch panel display unit 38 which can set washing machine 200 by directly touching the pattern of the switch displayed on liquid crystal panel 34 via transparent plate 31. Touch panel display unit 38 is integrally configured so that an operation section and a display section are superimposed on each other. This enables an intuitive operation. Accordingly, it is possible to improve usability and to improve visibility by changing a size of the pattern of the switch using the setting conditions. Therefore, it is possible to improve design universally.

Industrial Applicability

[0116] As described above, according to the present invention, a special advantageous effect can be achieved in that it is possible to provide an operation display device of a washing machine and a washing machine which allow usability to be improved and have excellent visibility. Accordingly, the present invention is useful as the operation display device of the washing machine having an operation unit on which a liquid crystal display is mounted, and the washing machine. In addition, the present invention can be applied to various devices which have touch panel display units and use water.

DESCRIPTION OF REFERENCE NUMERALS AND SIGNS

[0117]

12	main body
13	water tub
14	rotary drum
15	laundry loading and unloading port
16	front frame
17	loading opening
18	door
19	through-hole
20	motor
21	water injection pipe
22	drain pipe
23	water injection valve
24	drain valve
25	operation display panel
26	detergent loading case
27	top plate
28	transparent resin portion
29	panel sheet
30	opening
31	transparent plate
32	elastic body
33	transparent electrode
34	liquid crystal panel
35	liquid crystal attachment base
36	main control board
37	double-sided transparent tape
38	touch panel display unit

39	microcomputer
40	touch panel dedicated IC
41	upper side
42	lower side
43	left side
44	right side
45	boss
46	rear surface cover
47	screw
48	pressing operation button unit
49	switch
50	sub-control board
51	operation member
52	power-on button
53	power-off button
54	start button
55	return button
56a	touch button for washing and rinsing
56b	touch button for washing to drying
56c	touch button for drying
57a	touch button for frequent use
57b	touch button for favorite course
57c	touch button for other courses
58	touch button for menu
59a	touch button for washing
59b	touch button for rinsing
59c	touch button for spin-drying
60a	touch button for water level
60b	touch button for bath
60c	touch button for reservation
61	slide button for washing
62	touch button for determination
63a	touch button for night
63b	touch button for home cleaning
63c	touch button for power cleaning and deodorizing
63d	touch button for blanket
63e	touch button for elaborate finishing
63f	touch button for tub cleaning
64a	touch button for simple operation guide
64b	touch button for course manual
64c	touch button for care method
64d	touch button for resetting
65	glass substrate
66	X-electrode
67	Y-electrode
68	wiring unit
69	shield electrode
70	FPC wire
80	button opening
150	operation display device
200	washing machine

Claims

1. An operation display device of a washing machine, comprising:

a touch panel display unit that has a liquid crystal panel which displays a setting condition and a setting button of washing, rinsing, and spin-drying, that has a transparent plate which is arranged to overlap the liquid crystal panel and has a transparent electrode, and that is operated by the transparent plate being touched with a finger;

a pressing operation button unit that is disposed separately from the touch panel display unit, and that is operated by being pressed with a finger; and

an operation display panel that includes the touch panel display unit and the pressing operation button unit,

wherein a power-on button for turning on power of the washing machine is included in the pressing operation button unit.

2. An operation display device of a washing machine, comprising:

a touch panel display unit that has a liquid crystal panel which displays a setting condition and a setting button of washing, rinsing, and spin-drying, that has a transparent plate which is arranged to overlap the liquid crystal panel and has a transparent electrode, and that is operated by the transparent plate being touched with a finger;

a pressing operation button unit that is disposed separately from the touch panel display unit, and that is operated by being pressed with a finger; and

an operation display panel that includes the touch panel display unit and the pressing operation button unit,

wherein a power-off button for turning off power of the washing machine is included in the pressing operation button unit.

3. The operation display device of a washing machine of Claim 1 or 2,

wherein the transparent electrode is configured to detect a change in capacitance when touched with a finger, via the transparent plate.

4. The operation display device of a washing machine of any one of Claims 1 to 3,

wherein an opening which exposes the transparent plate is disposed in the operation display panel, and an elastic body arranged on a periphery of the transparent plate comes into pressurizing contact with and seals the periphery of the opening.

5. The operation display device of a washing machine of any one of Claims 1 to 4,

wherein the pressing operation button unit has a

switch, an operation member which performs a pressing operation on the switch, a button opening which is disposed in the operation display panel in order to press the operation member, and a panel sheet which closes the button opening and is integrally molded on a surface of the operation display panel.

6. A washing machine comprising:

the operation display device of a washing machine of any one of Claims 1 to 5.

FIG. 1

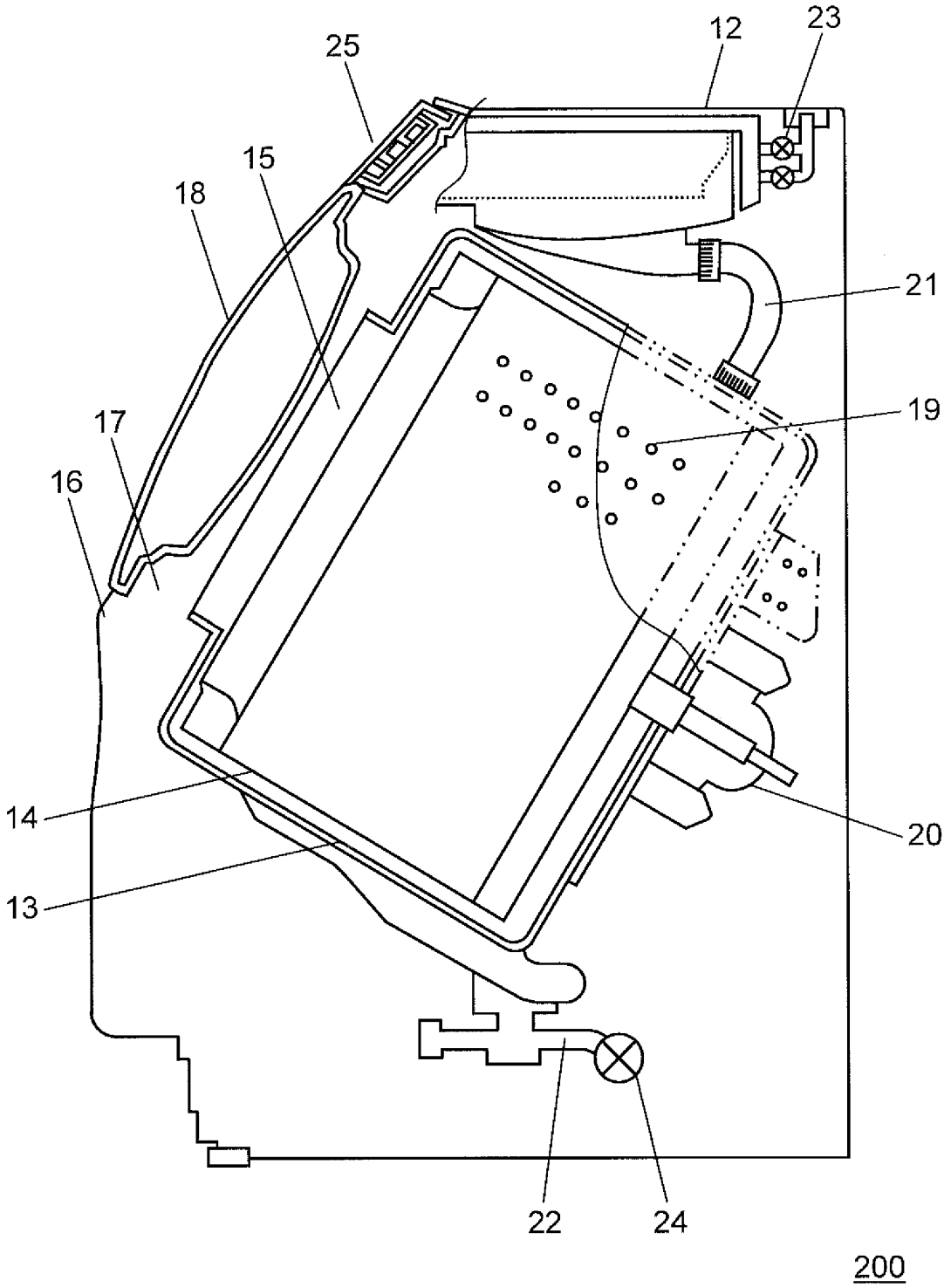


FIG. 2

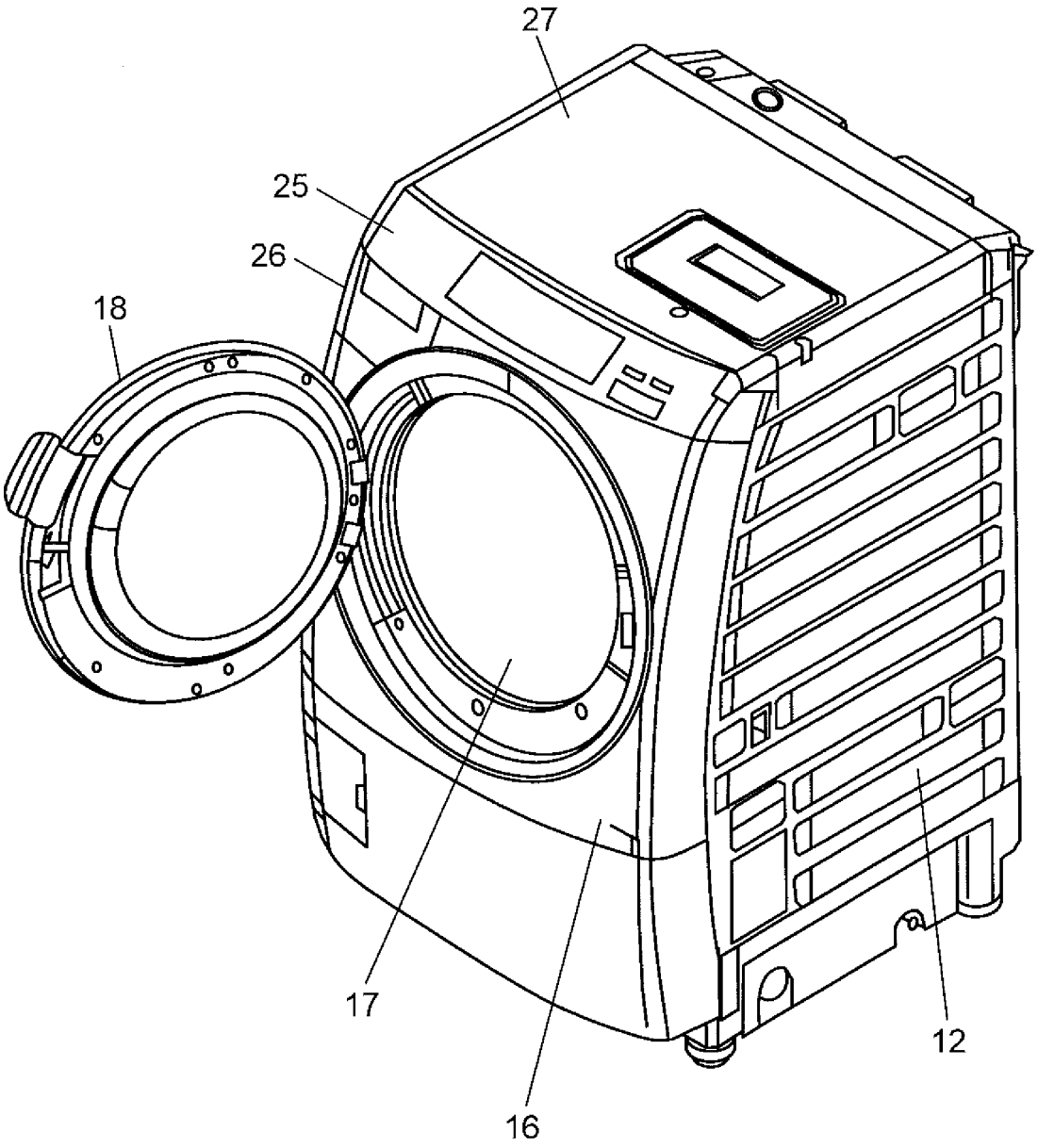


FIG. 3

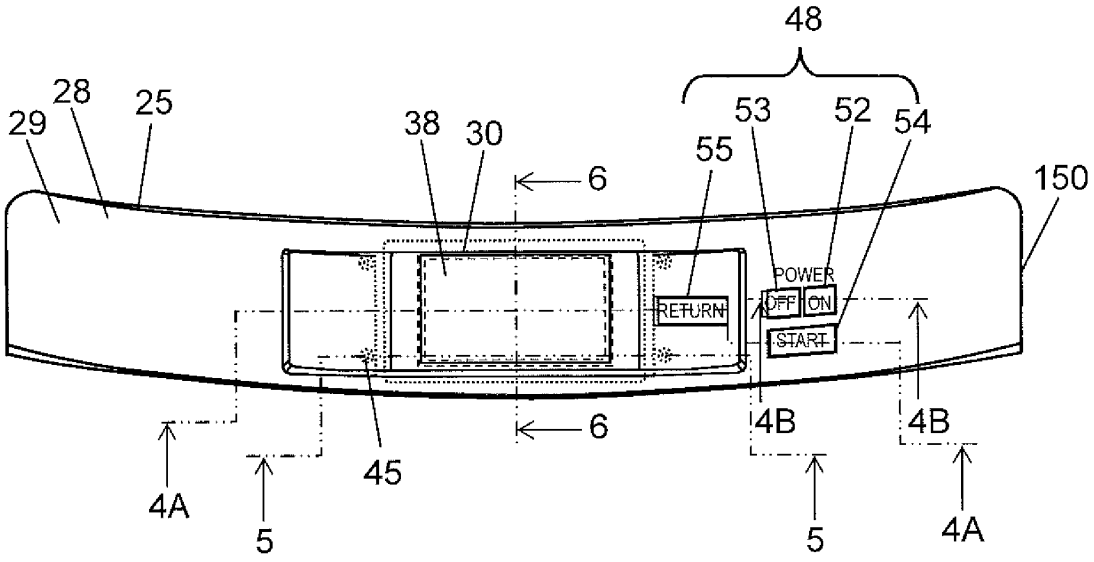

48
28
25
29
38
30
6
55
53
52
54
150
POWER
OFF
ON
RETURN
START
4B
4B
6
45
4A
5
5
4A

FIG. 4A

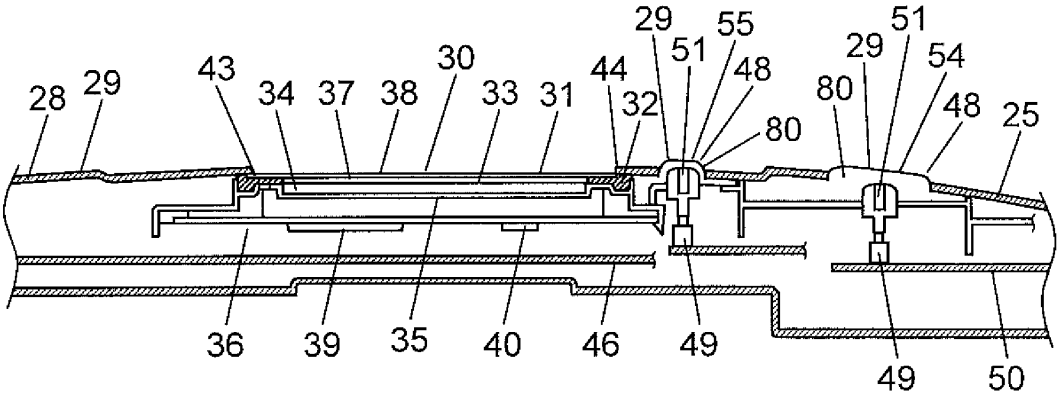


FIG. 4B

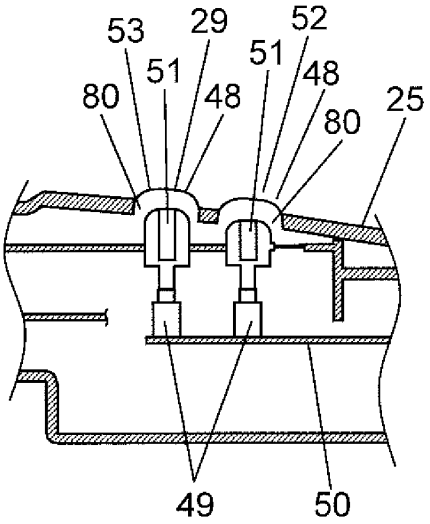


FIG. 5

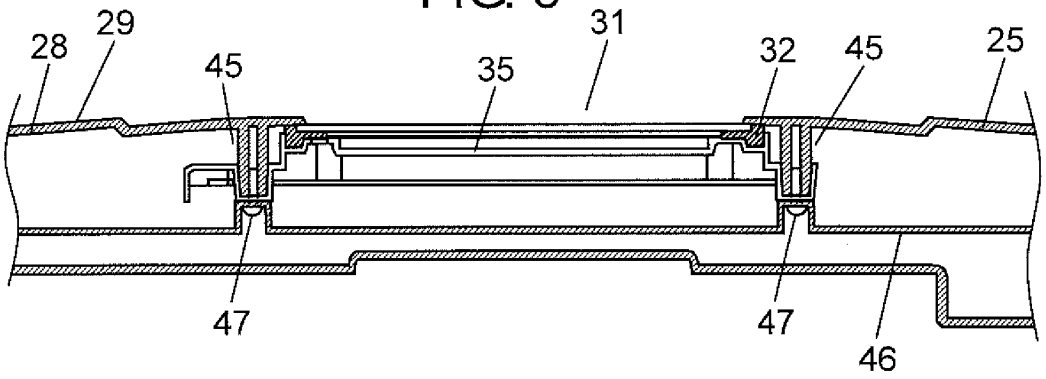


FIG. 6

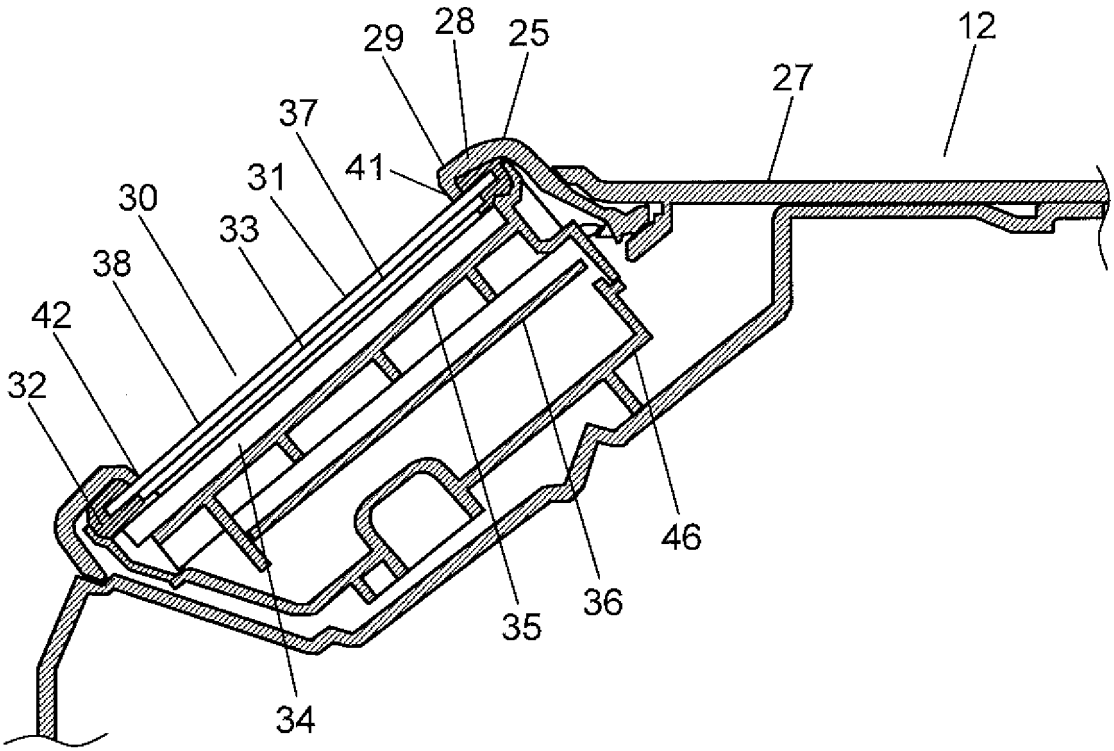


FIG. 7A

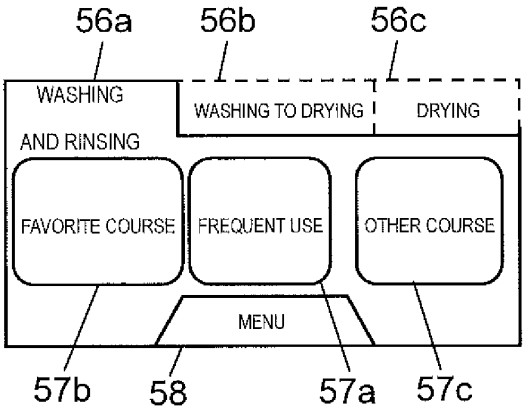


FIG. 7B

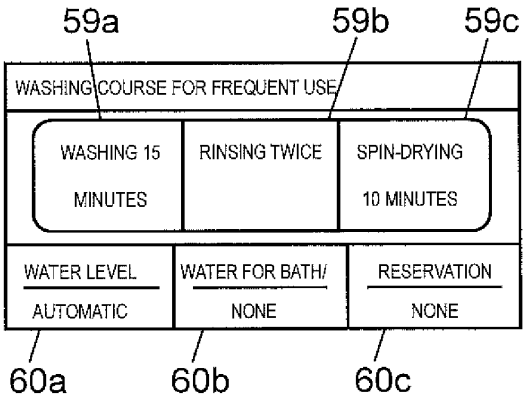


FIG. 7C

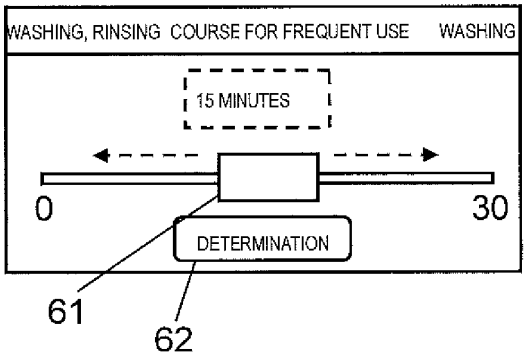


FIG. 7D

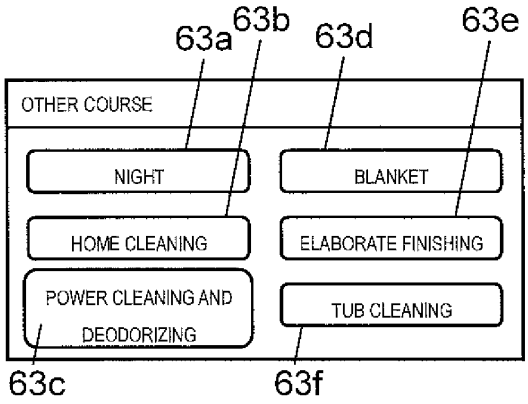


FIG. 7E

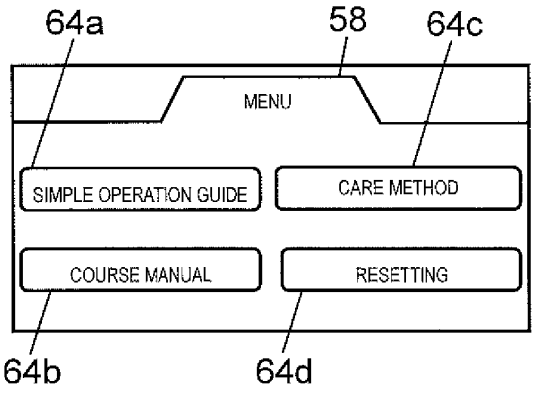


FIG. 7F

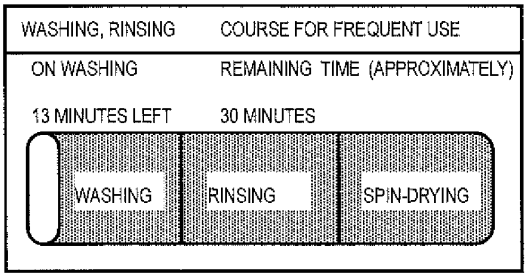


FIG. 8

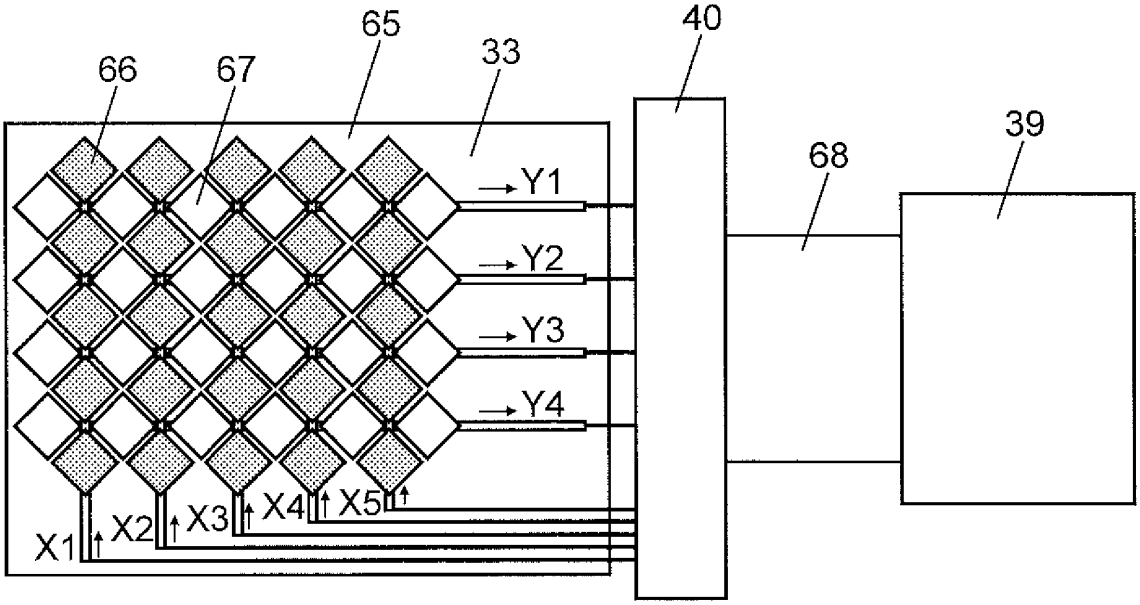

65
40
66
67
33
39
68
Y1
Y2
Y3
Y4
X1
X2
X3
X4
X5

FIG. 9

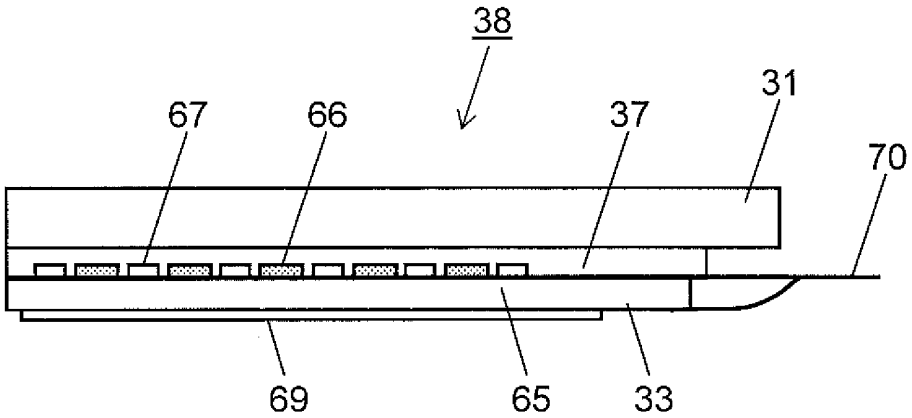

38
31
67
66
37
70
69
65
33

FIG. 10

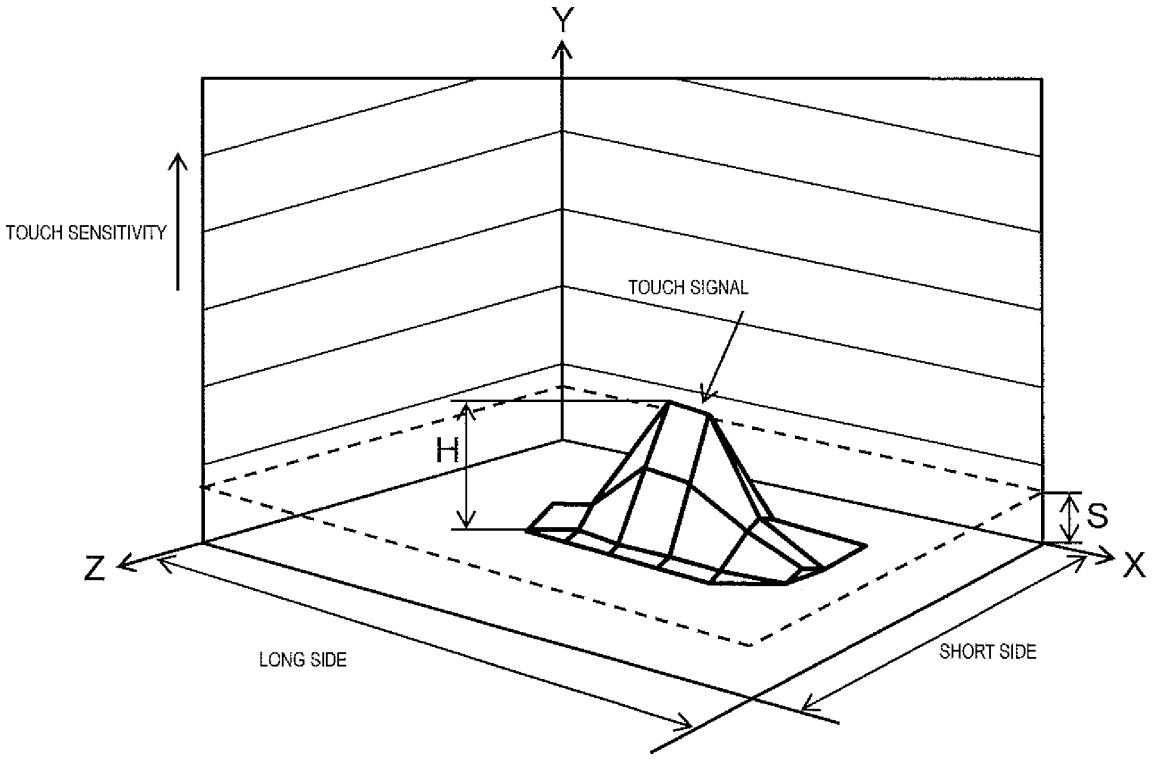

Y
TOUCH SENSITIVITY
TOUCH SIGNAL
H
S
Z
X
LONG SIDE
SHORT SIDE

FIG. 11

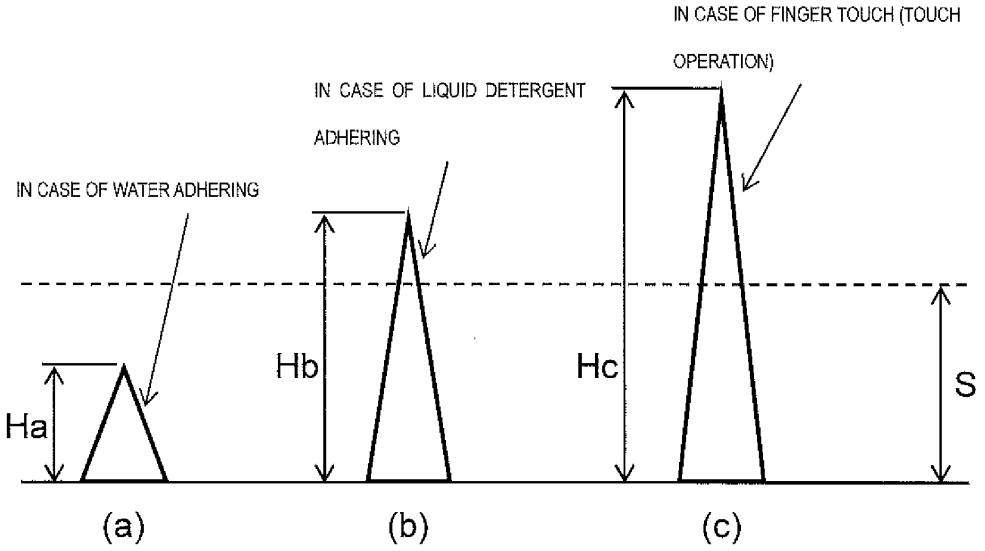

IN CASE OF FINGER TOUCH (TOUCH OPERATION)
IN CASE OF LIQUID DETERGENT ADHERING
IN CASE OF WATER ADHERING
Ha
Hb
Hc
S
(a)
(b)
(c)

FIG. 12

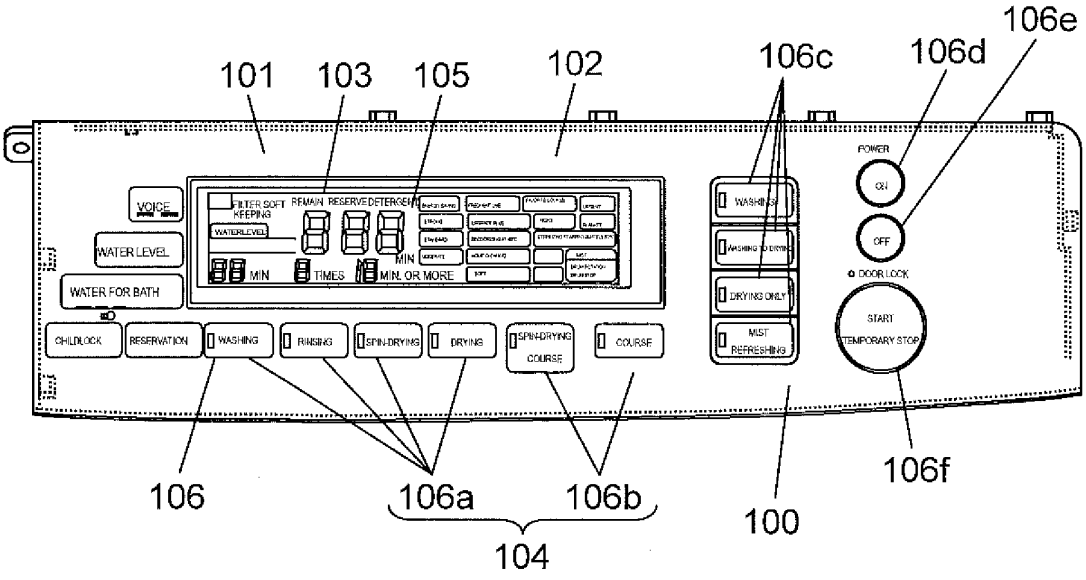
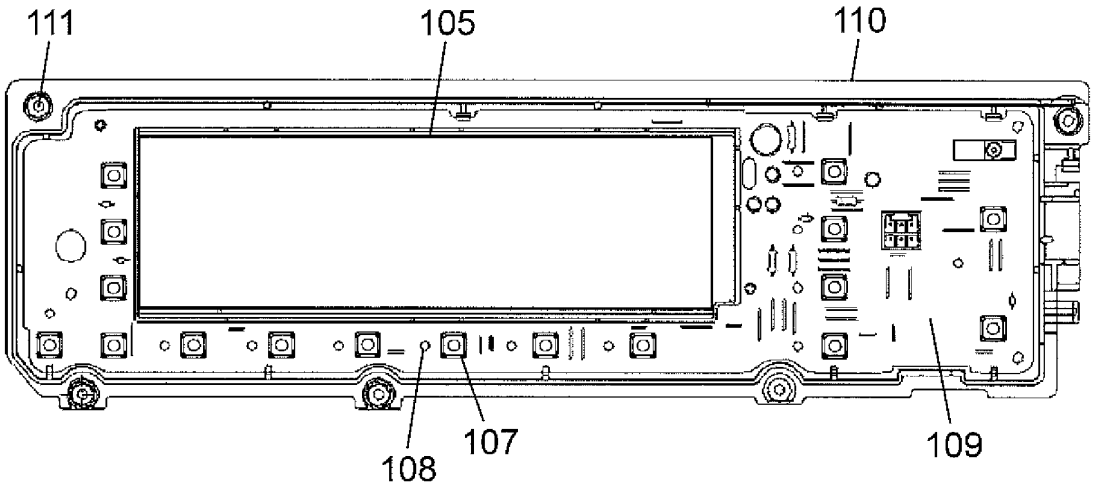

101
103
105
102
106c
106d
106e
VOICE
WATER LEVEL
WATER FOR BATH
FILTER SOFT KEEPING
REMAIN
RESERVE DETERGENT
WATER LEVEL
MIN
TIMES
MIN. OR MORE
WASHING
DRYING ONLY
MIST REFRESHING
POWER
ON
OFF
DOOR LOCK
START
TEMPORARY STOP
CHILDLOCK
RESERVATION
WASHING
RINSING
SPIN-DRYING
DRYING
SPIN-DRYING COURSE
COURSE
106
106a
106b
104
100
106f

FIG. 13


111
105
110
108
107
109

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2013/003915

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

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.
X Y	JP 2002-253892 A (Hitachi, Ltd.), 10 September 2002 (10.09.2002), paragraphs [0004], [0006], [0011] to [0016], [0073] to [0077]; fig. 1 to 6, 21 & US 2002/0116959 A1 & KR 10-2002-0070039 A & CN 1373249 A	1-2,4,6 3,5
Y A	JP 2010-183941 A (Panasonic Corp.), 26 August 2010 (26.08.2010), paragraphs [0006], [0015] to [0017], [0021]; fig. 1 (Family: none)	3,5 1-2,4,6
Y A	JP 2009-189678 A (Panasonic Corp.), 27 August 2009 (27.08.2009), paragraphs [0030], [0040] to [0041]; fig. 3 (Family: none)	5 1-4,6

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	JP 9-84989 A (Hitachi, Ltd.), 31 March 1997 (31.03.1997), entire text; all drawings (Family: none)	1-6
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