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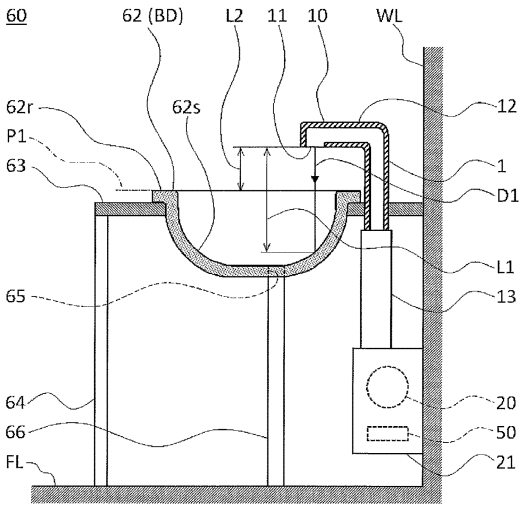
(54) HAND DRYING DEVICE, WASHBASIN WITH HAND DRYING DEVICE, AND METHOD FOR CONTROL OF HAND DRYING DEVICE

(57) This hand dryer device includes a nozzle unit including an air outlet for blowing air out in a predetermined blowing direction, a blower that supplies air to be blown out of the air outlet to the nozzle unit, a distance detection means that detects a distance between an object and the nozzle unit, the object being disposed apart from the air outlet in the blowing direction, a hand detection means that detects a hand being placed between the object and the nozzle unit, and a control unit that sets a rotational speed of the blower based on the distance detected by the distance detection means, and drives the blower when the hand detection means detects a hand. A rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

FIG.1



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Description

Field

[0001] This invention relates to a hand dryer device that blows air to dry user's hands, to a washstand with the hand dryer device, and to a method for controlling a hand dryer device.

Background

[0002] One known conventional hand dryer device includes a body, a high-pressure airflow generation unit that draws external air into an inside of the body, a nozzle provided on the body, which is configured to eject high-pressure air from the high-pressure airflow generation unit as high-speed air, a support member that supports the body, and a fixing member configured to attach the support member to a detergent container holding arm attached to a washstand or wash bowl so as to fix the support member to the detergent container holding arm (see, e.g., Patent Literature 1).

Citation List

Patent Literature

[0003] Patent Literature 1: Japanese Patent Application Laid-open No. 2008-272086 (Paragraph 0010 and FIG. 1)

Summary

Technical Problem

[0004] The foregoing conventional hand dryer device is configured such that the body is fixed to the detergent container holding arm using the support member, and the air ejected from the nozzle provided on the body is blown toward the wash bowl. In this regard, in case the wash bowl has a shallow depth or in a similar case, the air impinges on the wash bowl with a high speed being maintained without change to cause a splash of water drops remaining on the wash bowl to the surroundings of the bowl. This has presented a problem in that the user or things around the wash bowl may be caused to get wet, thereby making the user uncomfortable.

[0005] This invention has been made to solve the foregoing problems, and it is an object of the present invention to provide a hand dryer device, a washstand with a hand dryer device, and a method for controlling a hand dryer device, each of which is capable of preventing water remaining on the wash bowl from being splashed to the surroundings due to blown air, and thereby avoiding making the user uncomfortable.

Solution to Problem

[0006] The present invention provides a hand dryer device comprising: a nozzle unit having an air outlet to blow air out in a blowing direction that has been preset; a blower to supply air to be blown out of the air outlet to the nozzle unit; a distance detection means to detect a distance between an object and the nozzle unit, the object being disposed apart from the air outlet in the blowing direction; a hand detection means to detect whether or not there is a hand being placed between the object and the nozzle unit; and a control unit to set a rotational speed of the blower based on the distance detected by the distance detection means, and drive the blower when the hand detection means detects a hand, wherein a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

[0007] The present invention also provides a washstand with a hand dryer device, comprising: a water discharge unit to discharge water; a wash bowl having an inner surface to receive the water discharged from the water discharge unit; a nozzle unit that is provided above the wash bowl, and has an air outlet to blow air out in a blowing direction directed to the inner surface of the wash bowl; a blower to supply air to be blown out of the air outlet to the nozzle unit; a distance detection means to detect a distance between an object and the nozzle unit, the object being disposed apart from the air outlet in the blowing direction; a hand detection means to detect whether or not there is a hand being placed between the object and the nozzle unit; and a control unit to set a rotational speed of the blower based on the distance detected by the distance detection means, and drive the blower when the hand detection means detects a hand, wherein a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

[0008] The present invention further provides a method for controlling a hand dryer device including a nozzle unit having an air outlet to blow air out in a blowing direction that has been preset, a blower to supply air to be blown out of the air outlet to the nozzle unit, a distance detection means, a hand detection means, and a control unit, the method comprising: a step of detecting a distance between an object and the nozzle unit by the distance detection means, the object being disposed apart from the air outlet in the blowing direction; a step of setting a rotational speed of the blower by the control unit based on the distance detected by the distance detection means; a step of detecting, by the hand detection means, whether or not there is a hand being placed between the object and the nozzle unit; and a step of driving the blower by the control unit at the set rotational speed, when the

hand detection means detects a hand, wherein a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

Advantageous Effects of Invention

[0009] A hand dryer device, a washstand with a hand dryer device, and a method for controlling a hand dryer device of this invention can prevent water remaining on an object such as a wash bowl disposed apart from the air outlet from being splashed to the surroundings thereof due to the blown air, and can avoid making the user uncomfortable.

Brief Description of Drawings

[0010]

FIG. 1 is a schematic sectional side view of a washstand with a hand dryer device according to a first embodiment of this invention.

FIG. 2 is a plan view of the washstand with a hand dryer device according to the first embodiment of this invention.

FIG. 3 is a bottom view of a nozzle unit of the hand dryer device according to the first embodiment of this invention.

FIG. 4 is a block diagram of a main part involved in control of the hand dryer device according to the first embodiment of this invention.

FIG. 5 is a diagram illustrating an example of a hardware configuration of a processing circuit of the hand dryer device according to the first embodiment of this invention.

FIG. 6 is a flowchart of operation control provided by the hand dryer device according to the first embodiment of this invention.

FIG. 7 is a table illustrating an example of the relationship between the distance between an object and a nozzle unit and the rotational speed of the blower.

FIG. 8 is a table illustrating an example of the relationship between a dimensionless distance and the rotational speed of the blower.

FIG. 9 is a schematic sectional side view of another washstand with a hand dryer device according to the first embodiment of this invention.

FIG. 10 is a bottom view of a nozzle unit of a hand dryer device according to a second embodiment of this invention.

Description of Embodiments

[0011] Embodiments of the present invention will be described below with reference to the accompanying drawings. Identical or equivalent elements are designated by the same reference characters in the drawings.

First Embodiment.

[0012] FIG. 1 is a schematic sectional side view of a washstand with a hand dryer device 60 (hereinafter referred to simply as "washstand 60") provided with a hand dryer device 1 according to the present embodiment. FIG. 2 is a plan view of the washstand 60.

[0013] The washstand 60 includes a water discharge unit 61 and a wash bowl 62. The water discharge unit 61 discharges water. The wash bowl 62 receives the water discharged from the water discharge unit 61 on an inner surface 62s thereof. In the present embodiment, the wash bowl 62 is supported by a counter unit 63. The counter unit 63 is formed of an upper portion of a box-shaped body 64 disposed on a floor FL with the counter unit 63 being adjacent to a wall WL. The counter unit 63 has a top surface formed to be horizontal, and has an opening formed in a center portion of the unit 63. The wash bowl 62 is set in a manner that the bowl 62 covers the opening of the counter unit 63.

[0014] The water discharge unit 61 is disposed to stand on the counter unit 63 between the wash bowl 62 and the wall WL, and is set to discharge water toward the inner surface 62s of the wash bowl 62. The water discharge unit 61 is, for example, a faucet connected to a water pipe. The water discharge unit 61 passes through the counter unit 63, and is connected to a waterworks system (not illustrated) for supplying water to be discharged. The water discharge unit 61 includes a sensor, a control circuit, and a solenoid valve each of which is conventionally used and is not illustrated. Detection of a user's hand by this sensor causes the solenoid valve to open automatically, and causes water to be discharged from the water discharge unit 61.

[0015] The wash bowl 62 has a concave shape to form the inner surface 62s having a smoothly curved surface, and is made of, for example, a ceramic material. A drain outlet 65 is formed in a lowest bottom portion of the wash bowl 62. The drain outlet 65 is an opening provided to drain the water discharged from the water discharge unit 61 and received by the wash bowl 62, to a sewerage line. The drain outlet 65 is connected with a drainpipe 66 thereunder. The drainpipe 66 has a drain trap (not illustrated), and is connected to a sewerage line (not illustrated) through the drain trap.

[0016] The drain outlet 65 is provided with a drain stopper 67 that can switch the drain outlet 65 to be in an open state or a closed state. For example, the drain stopper 67 is configured to be moved up and down by a user's operation of a lever (not illustrated) provided on the washstand 60 to switch the drain outlet 65 between an open state and a closed state. When the drain stopper 67 is at the lowest end position in the movable range thereof, the drain outlet 65 is closed, thereby allowing the water discharged from the water discharge unit 61 to be stored in the wash bowl 62. When the drain stopper 67 is at the

highest end position in the movable range thereof, the drain outlet 65 is open, thereby allowing the water discharged from the water discharge unit 61 to be drained through the drainpipe 66.

[0017] The washstand 60 is provided with the hand dryer device 1. The hand dryer device 1 includes a nozzle unit 10, a blower 20, distance detection means 30, hand detection means 40, and a control unit 50.

[0018] The nozzle unit 10 has an air outlet 11 configured to blow air in a preset blowing direction D1.

[0019] In the present embodiment, the hand dryer device 1 has a body unit 12 having a tubular shape. The body unit 12 is disposed to stand on the counter unit 63 between the wash bowl 62 and the wall WL, alongside of the water discharge unit 61, and is bent toward the wash bowl 62. The nozzle unit 10 is formed in a leading end portion of the bent body unit 12, and is set at a position above the wash bowl 62. The air outlet 11 is formed in a portion facing the wash bowl 62, of the end portion of the body unit 12. The blowing direction D1 of the air outlet 11 corresponds to a direction toward the inner surface 62s of the wash bowl 62. In addition, the blowing direction D1 is set not to meet up with the drain outlet 65 formed on the wash bowl 62. This can prevent the air blown out of the air outlet 11 from directly flowing into the drainpipe 66.

[0020] FIG. 3 is a bottom view of the nozzle unit 10. As illustrated in FIG. 3, the air outlet 11 is formed in a long, narrow slit shape. The air outlet 11 extends in the direction in which the end portion of the body unit 12 extends. The air outlet 11 has a slit width (width in the lateral direction) set to have a dimension of, for example, 2 mm or less.

[0021] As illustrated in FIG. 1, the body unit 12 extends to penetrate the counter unit 63, and is fixed to the counter unit 63 using, for example, a fixing nut not illustrated. The body unit 12 is connected to an air-blow duct 13 under the counter unit 63. The air-blow duct 13 is formed in a tubular shape to be coupled with the body unit 12 and the blower 20. The air-blow duct 13 is made of, for example, a flexible resin that would be adopted in order to facilitate construction work.

[0022] The blower 20 feeds air to be blown out of the air outlet 11 to the nozzle unit 10. In the present embodiment, the blower 20 includes a motor and a turbofan rotated by this motor, and is configured to generate high-pressure air. In addition, the blower 20 is housed in a power block case 21 disposed below the counter unit 63. The power block case 21 is installed on the wall WL inside the box-shaped body 64. The power block case 21 has an air inlet (not illustrated) for allowing the blower 20 to take in air from outside the power block case 21. The air inlet has an air filter removably installed therein to prevent incursion of dust. Examples of the air filter include a mesh filter, a high-efficiency particulate air (HEPA) filter, a sterilization filter, and so on. This air inlet communicates with an air-intake side of the blower 20. In addition, an air-exhaustion side of the blower 20 is connected to the air-blow duct 13. The high-pressure air generated by the blower 20 is delivered to the nozzle unit 10 through the air-blow duct 13 and through the body unit 12, and blows out of the air outlet 11 as a high-speed airflow. The air blown out of the air outlet 11 has a speed that depends on the rotational speed of the blower 20 (the number of rotations of the fan of the blower 20 per unit time). Specifically, a higher rotational speed of the blower 20 results in a higher pressure generated by the blower 20, and hence a higher speed of the air blown out of the air outlet 11. Such configuration in the present embodiment allows air to be blown out of the air outlet 11 having a slit shape as an air jet. The air at the time of this blowout has a speed of, for example, 80 m/s or higher.

[0023] In addition, a heater (not illustrated) for heating the high-pressure air generated by the blower 20 is provided in the power block case 21. Use of this heater can make the air to be blown out of the air outlet 11 a warm airflow.

[0024] The distance detection means 30 detects a distance L1 between an object BD situated apart from the air outlet 11 in the blowing direction D1 and the nozzle unit 10. In the present embodiment, the blowing direction D1 is toward the inner surface 62s of the wash bowl 62. For this reason, the object BD situated apart from the air outlet 11 in the blowing direction D1 is, for example, the wash bowl 62. In this case, the distance detection means 30 detects the distance between the wash bowl 62 and the nozzle unit 10. Alternatively, for example, when the drain outlet 65 is closed by the drain stopper 67 of the wash bowl 62 and water is being stored in the wash bowl 62, the object BD is the water actually stored in the wash bowl 62. In this case, the distance detection means 30 detects the distance between the surface of the water stored in the wash bowl 62 and the nozzle unit 10. As illustrated in FIG. 3, the distance detection means 30 is set adjacent to the air outlet 11 in the nozzle unit 10. As the distance detection means 30, an optical distance sensor can be used, for example. In an optical distance sensor, light radiated from a light source set inside the distance sensor is caused to impinge on the object BD and then to be reflected therefrom, and the reflected light is received by a light-receiving device of the distance sensor. The distance in question is measured based on a difference between the amount of luminescence in the light source and the amount of light received in the light-receiving device.

[0025] The distance L1 detected by the distance detection means 30 will now be described. As illustrated in FIG. 1, in the present embodiment, the distance detection means 30 detects the distance L1 between the object BD and the nozzle unit 10 along the blowing direction D1. That is, the distance L1 is related to the flow of air blown out from the air outlet 11 in the blowing direction D1. In general, impingement of the air blown out from the air outlet 11 onto the object BD at a high speed is likely to cause a splash of water drops remaining on the object BD. Conversely, impingement of the air blown out from

the air outlet 11 onto the object BD at a low speed is less likely to cause a splash of water drops remaining on the object BD. In addition, the speed of the air blown out from the air outlet 11 gradually decreases as the air flows more distantly from the air outlet 11 in the blowing direction D1. It is therefore considered that air blown out of the air outlet 11 that has flowed a certain distance from the air outlet 11, thus having a sufficiently reduced speed, will not cause a splash of water drops remaining on the object BD even if the air impinges on the object BD. From this viewpoint, the distance L1 associated with the flow of the air blown out of the air outlet 11 is detected by the distance detection means 30.

[0026] Specifically, in the present embodiment, as the distance L1, a distance between the air outlet 11 of the nozzle unit 10 and the object BD is set. That is, the distance L1 is equivalent to the distance of movement of the air blown out of the air outlet 11 in the blowing direction D1 from the air outlet 11 until impingement on the object BD. Note that in a case in which the flow of the air blown out of the air outlet 11 is an air jet, the blowing direction D1 is aligned with a jet axis thereof. In a case of a short distance L1, the air blown out of the air outlet 11 impinges on the object BD at a speed near the speed at which the air starts to be blown, and is thus likely to cause a splash of water drops remaining on the object BD. In contrast, in a case of a long distance L1, the air blown out of the air outlet 11 will has a reduced speed before reaching the object BD, and thus impinges on the object BD at a speed lower than the speed at which the air starts to be blown. Therefore, the air in that case is less likely to cause a splash of water drops remaining on the object BD.

[0027] Note that in a case in which the distance between the air outlet 11 of the nozzle unit 10 and the object BD is used as the distance L1, the distance detection means 30 ideally and preferably detects this distance between the air outlet 11 of the nozzle unit 10 and the object BD. In essence, however, because there is no significant error, the distance between a portion near the air outlet 11 of the nozzle unit 10 and the object BD may be equated to the distance between the air outlet 11 of the nozzle unit 10 and the object BD. In the present embodiment, the distance detection means 30 is disposed adjacent to the air outlet 11 in the nozzle unit 10 as described above, and the distance between this distance detection means 30 set adjacent to the air outlet 11 and the object BD is used as the distance between the air outlet 11 and the object BD.

[0028] The hand detection means 40 detects whether or not there is a hand being placed between the object BD that is disposed apart from the air outlet 11 in the blowing direction D1 and the nozzle unit 10. As described above, the object BD is, for example, the wash bowl 62 in the present embodiment, and therefore in this case, the hand detection means 40 detects whether or not there is a hand being placed between the wash bowl 62 and the nozzle unit 10. Alternatively, when some water has been already stored in the wash bowl 62, the hand detection means 40 detects whether or not there is a hand being placed between the water stored in the wash bowl 62 and the nozzle unit 10. As illustrated in FIG. 3, the hand detection means 40 is disposed adjacent to the air outlet 11 on the opposite side of the distance detection means 30 in the nozzle unit 10. As the hand detection means 40, an optical infrared sensor or distance sensor can be used, for example. An infrared sensor uses a light-receiving device to detect a user's hand by the device receiving infrared light reflected at the hand when infrared light emitted from an infrared light-emitting device has been incident on the user7s hand.

[0029] The control unit 50 sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30, and accordingly drives the blower 20 in a case in which the hand detection means 40 has detected a hand. In the present embodiment, the control unit 50 is disposed inside the power block case 21 as illustrated in FIG. 1. FIG. 4 is a block diagram of a main part involved in control of the hand dryer device 1. As illustrated in FIG. 4, the control unit 50 is communicably connected to each of the blower 20, the distance detection means 30, and the hand detection means 40, and such connection with each of them is made using a signal line, for example. The distance detection means 30 outputs a signal including information representing the distance L1 detected by the distance detection means 30, and sends the signal to the control unit 50. The hand detection means 40 outputs a signal including information representing the result of detection as to the presence or absence of a hand, and sends the signal to the control unit 50. The control unit 50 outputs a signal for controlling the operation of the blower 20 on the basis of the signal outputted from the distance detection means 30 and the signal outputted from the hand detection means 40, and sends the signal to the blower 20. The blower 20 operates according to the signal outputted from the control unit 50 to blow air out of the air outlet 11 of the nozzle unit 10.

[0030] In the present embodiment, as illustrated in FIG. 4, the control unit 50 includes a distance determination unit 51, an operation control unit 52, and a storage unit 53. The distance determination unit 51 compares the distance L1 detected by the distance detection means 30 with a preset distance to determine the magnitude relationship therebetween. The operation control unit 52 sets the rotational speed of the blower 20 based on the determination result of the distance determination unit 51. In addition, the operation control unit 52 drives the blower 20 based on the detection result of the hand detection means 40. The storage unit 53 stores distances and rotational speeds, which have been set in advance. The components in the control unit 50 are capable of communicating information with one another.

[0031] Control provided by the control unit 50 to set the rotational speed of the blower 20 based on the distance detected by the distance detection means 30 will next be described. The present embodiment is based on

the assumption that the rotational speed of the blower 20 set by the control unit 50 has a relationship in which a rotational speed of the blower 20 that is set when the distance detected by the distance detection means 30 is less than a first distance is less than a rotational speed of the blower 20 that is set when the distance detected by the distance detection means 30 is equal to the first distance.

[0032] A specific example of setting the rotational speed of the blower 20 will now be described. First, the preset distance and the preset rotational speed are stored in advance in the storage unit 53. For example, the storage unit 53 has a first distance as the preset distance stored therein, and has a first rotational speed and a second rotational speed less than the first rotational speed as the preset rotational speed stored therein. In this regard, the first rotational speed is set to a rotational speed of the blower 20 such that, upon impingement of air delivered from the blower 20 and blown out of the air outlet 11 of the nozzle unit 10 on the object BD, the impinging air has a speed low enough not to cause a splash of water drops remaining on the object BD, in the case where the distance L1 between the object BD and the nozzle unit 10 is equal to the first distance. The second rotational speed is set to a rotational speed of the blower 20 such that, upon impingement of air blown out of the air outlet 11 of the nozzle unit 10 on the object BD, the impinging air has a speed low enough not to cause a splash of water drops remaining on the object BD, in the case where the distance L1 between the object BD and the nozzle unit 10 is less than the first distance. By way of example of the speed low enough not to cause a splash of water drops remaining on the object BD, when the speed upon impingement of air blown out of the air outlet 11 on the object BD is 20 m/s or lower, an airflow at this speed does not have kinetic energy enough to blow away water drops remaining on the object BD, so that a splash of the water drops can be prevented.

[0033] Upon reception of the signal outputted from the distance detection means 30, the distance determination unit 51 of the control unit 50 determines whether or not the distance L1 detected by the distance detection means 30 is greater than or equal to the first distance in the storage unit 53, and outputs its determination result to the operation control unit 52. When the distance determination unit 51 determines that the distance L1 detected by the distance detection means 30 is greater than or equal to the first distance, the operation control unit 52 sets the rotational speed of the blower 20 to the first rotational speed. When the distance determination unit 51 determines that the distance L1 detected by the distance detection means 30 is less than the first distance, the operation control unit 52 sets the rotational speed of the blower 20 to the second rotational speed.

[0034] Drive control on the blower 20 performed by the control unit 50 based on the detection result from the hand detection means 40 will next be described. The hand detection means 40 outputs, to the control unit 50, a hand detection signal that represents a detection result as to whether it has been detected that a user's hand has been placed between the object BD and the nozzle unit 10. For example, the hand detection means 40 outputs a high-level signal to the control unit 50 when a hand is being detected, but outputs a low-level signal to the control unit 50 when no hand is being detected. When the hand detection signal received by the control unit 50 is a high-level signal, the operation control unit 52 determines that a hand is placed between the object BD and the nozzle unit 10, and so drives the blower 20 to rotate, or keeps the blower 20 rotating. When the hand detection signal received by the control unit 50 is a low-level signal, the operation control unit 52 determines that no hand is placed between the object BD and the nozzle unit 10, and so stops the blower 20, or keeps the blower 20 stopped.

[0035] In the present embodiment, as described above, the distance detection means 30 is disposed adjacent to the air outlet 11 in the nozzle unit 10, and the hand detection means 40 is disposed adjacent to the air outlet 11 on the opposite side of the distance detection means 30. That is, the distance detection means 30 and the hand detection means 40 are disposed close to each other. For this reason, if the control unit 50 simultaneously performs the control relating to the distance detection means 30 and the control relating to the hand detection means 40, the distance detection means 30 may wrongly identify the user's hand detected by the hand detection means 40, as the object BD, and detect a distance between this user's hand and the nozzle unit 10, so that the control unit 50 may erroneously set the rotational speed of the blower 20 based on this distance. Therefore, the control unit 50 does not perform any operation of setting the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30 when the hand detection means 40 detects a user's hand, but the unit 50 sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30 when the hand detection means 40 detects no user's hand.

[0036] The control unit 50 is implemented in, for example, a processing circuit having a hardware configuration illustrated in FIG. 5. FIG. 5 is a diagram illustrating an example of a hardware configuration of the processing circuit. Components constituting the control unit 50 are implemented by, for example, a processor 71 illustrated in FIG. 5 executing a program stored in a memory 72. Moreover, multiple processors and multiple memories may provide the above-mentioned functions in conjunction with each other. The functions of the control unit 50 may be implemented such that some of the functions is/are implemented in an electronic circuit and the remainder thereof is implemented using the processor 71 and the memory 72.

[0037] An operation of the hand dryer device 1 in the present embodiment will next be described with reference to FIG. 6. FIG. 6 is a flowchart of operation control

provided by the hand dryer device 1.

[0038] Powering on of the hand dryer device 1 causes the hand dryer device 1 to become in a standby state. That is, this state is a state in which the blower 20 is stopped and the hand detection means 40 does not detect any hands. First, at step S1, the distance detection means 30 detects the distance L1 between the object BD and the nozzle unit 10, and outputs a signal including information representing the distance L1 detected, to the control unit 50.

[0039] Next, at step S2, the control unit 50 sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30. In more detail, the distance determination unit 51 of the control unit 50 compares the distance L1 detected by the distance detection means 30 with a preset distance to determine the magnitude relationship therebetween. The operation control unit 52 sets the rotational speed of the blower 20 based on the determination result of the distance determination unit 51.

[0040] Next, at step S3, the hand detection means 40 detects whether or not there is a hand being placed between the object BD and the nozzle unit 10, and outputs a hand detection signal representing the detection result to the control unit 50. At this step S3, it is determined whether or not a user's hand has been placed between the object BD and the nozzle unit 10. When the hand detection signal received by the control unit 50 from the hand detection means 40 indicates a fact that a hand is detected, this means that a user's hand has been placed between the object BD and the nozzle unit 10. In this case, the control unit 50 proceeds to a process of step S4. When the hand detection signal received by the control unit 50 from the hand detection means 40 indicates a fact that a hand is not detected, this means that a user's hand has not been placed between the object BD and the nozzle unit 10. In this case, the control unit 50 proceeds to a process of step S7.

[0041] At step S4, the control unit 50 drives the blower 20 based on the detection result from the hand detection means 40. In more detail, when the hand detection signal received from the hand detection means 40 indicates a fact that a hand is detected, the operation control unit 52 of the control unit 50 determines that a hand is placed between the object BD and the nozzle unit 10, and thereupon subject the blower 20 to rotation operation at the rotational speed that has been set at step S2. This causes air to flow in from the air inlet through the air filter provided in the power block case 21, and to be delivered to the blower 20, and then the air is pressurized by the blower 20. The air pressurized by passing through the blower 20 passes through the air-blow duct 13, reaches the nozzle unit 10, is accelerated by the air outlet 11 of the nozzle unit 10, and is blown out from the air outlet 11 as a high-speed airflow. The air blown out from the air outlet 11 impinges on the user's hand placed between the object BD and the nozzle unit 10, and then starts to scatter some water remaining on a surface of the hand into water drops.

[0042] Next, at step S5, the hand detection means 40 detects the presence or absence of a hand placed between the object BD and the nozzle unit 10, and outputs a hand detection signal representing the detection result to the control unit 50. At this step S5, it is determined whether or not the user's hand placed between the object BD and the nozzle unit 10 has been pulled away therefrom. When the hand detection signal received from the hand detection means 40 indicates a fact that a hand is detected, the control unit 50 repeats the process of step S5. This situation means that the user's hand remains placed between the object BD and the nozzle unit 10, and therefore the operation control unit 52 of the control unit 50 keeps the blower 20 rotating. When the hand detection signal received from the hand detection means 40 indicates a fact that a hand is not detected, the control unit 50 proceeds to the process of step S6.

[0043] When the hand detection signal received by the control unit 50 from the hand detection means 40 indicates a fact that a hand is not detected, this means that the user's hand placed between the object BD and the nozzle unit 10 has been pulled away therefrom. At step S6, the operation control unit 52 of the control unit 50 stops the blower 20 that is rotating. This causes the air blown out of the air outlet 11 to stop. Then, the process returns to the process of step S3.

[0044] At step S3, when the hand detection signal received by the control unit 50 from the hand detection means 40 indicates a fact that a hand is not detected, the operation control unit 52 of the control unit 50 determines that no hand is placed between the object BD and the nozzle unit 10, and so keeps the blower 20 stopped.

[0045] Next, at step S7, the control unit 50 determines whether or not a preset time period has elapsed since the rotational speed of the blower 20 was set at step S2. If the preset time period has not elapsed, the operational flow returns to the process of step S3. If the preset time period has elapsed, the operational flow returns to the process of step S1 to update the rotational speed of the blower 20 that has been set at step S2. By doing so, the rotational speed of the blower 20 can be set anew in response to a change in the distance between the object BD and the nozzle unit 10 in cases such as when some water has been stored in the wash bowl 62.

[0046] As described above, the hand dryer device 1 according to the present embodiment includes: the nozzle unit 10 provided with the air outlet 11 to blow air out in the blowing direction D1 that has been preset; the blower 20 which supplies air to be blown out of the air outlet 11 to the nozzle unit 10; the distance detection means 30, which detects the distance L1 between the object BD disposed apart from the air outlet 11 in the blowing direction D1 and the nozzle unit 10; the hand detection means 40 which detects whether or not there is a hand being placed between the object BD and the nozzle unit 10; and the control unit 50 which sets the rotational speed of the blower 20 based on the distance L1 detected by

the distance detection means 30 and drives the blower 20 in a case in which the hand detection means 40 has detected a hand. The rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is less than the first distance is less than the rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is equal to the first distance.

[0047] Owing to such configuration, the rotational speed of the blower 20 when the blower 20 is to be driven in a case in which the hand detection means 40 has detected a hand is set based on the distance L1 detected by the distance detection means 30. This enables the rotational speed of the blower 20 to be changed depending on the distance L1 between the object BD and the nozzle unit 10, and the speed of the air blown out of the air outlet 11 to be changed accordingly. In addition, the rotational speed of the blower 20 that is set when the distance L1 is less than the predetermined first distance is less than the rotational speed of the blower 20 that is set when the distance L1 is equal to the first distance. Therefore, the speed of the air blown out of the air outlet 11 can be reduced when the distance L1 is smaller to thereby provide a reduced speed at which that air impinges on the object BD. Thus, when the air blown out of the air outlet 11 directly impinges on the object BD immediately after the hand placed between the object BD and the nozzle unit 10 was pulled away therefrom, or in a similar case, splash of some water remaining on the object BD to the surroundings can be prevented, wherein the splash would be caused by this blown-out air. As a result, it is possible to avoid making the user uncomfortable, and provide hygienic use.

[0048] In addition, since the control unit 50 automatically sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30, it is possible to eliminate some work of setting the rotational speed of the blower 20 in consideration of the depth of the wash bowl 62, which is performed during installation by the installer or constructor who are to install the hand dryer device 1 in a washstand or the like. Moreover, even when the distance L1 varies in cases such as when some water is stored in the wash bowl 62, the control unit 50 automatically sets the rotational speed of the blower 20 based on the distance L1 that has changed, so that a splash of the water stored in the wash bowl 62 can be prevented.

[0049] The control unit 50 sets the rotational speed of the blower 20 to a preset first rotational speed when the distance L1 detected by the distance detection means 30 is greater than or equal to the preset first distance, and sets the rotational speed of the blower 20 to a rotational speed less than the first rotational speed when the distance L1 detected by the distance detection means 30 is less than the first distance. Owing to such a configuration, the rotational speed of the blower 20 is set to a second rotational speed less than the first rotational speed when the distance L1 detected by the distance detection means 30 is less than the first distance serving as a criterion. Accordingly, the rotational speed of the blower 20 can be automatically reduced in a case where the distance L1 between the object BD and the nozzle unit 10 is less than a certain criterion, such as the case where the wash bowl 62 has a low value in depth, for example. This can make it even less likely to cause a splash of water drops remaining on the object BD.

[0050] The control unit 50 sets the rotational speed of the blower 20 based on the distance detected by the distance detection means 30 in a case in which the hand detection means 40 does not detect a hand. Such a configuration can prevent simultaneous performance of hand detection by the hand detection means 40 and distance detection by the distance detection means 30, and can thus prevent a situation in which, for example, the distance detection means 30 detects a distance from a hand placed between the object BD and the nozzle unit 10 and the rotational speed of the blower 20 is set erroneously based on that distance.

[0051] The distance detection means 30 is disposed adjacent to the air outlet 11 in the nozzle unit 10. Such a configuration enables the distance from the object BD with respect to the nozzle unit 10 to be easily detected. In particular, the distance between the air outlet 11 of the nozzle unit 10 and the object BD can be easily detected as the distance L1.

[0052] In addition, the hand dryer device-equipped washstand 60 according to the present embodiment includes: the water discharge unit 61 which discharges water; the wash bowl 62 having the inner surface 62s by which the water discharged from the water discharge unit 61 is received; the nozzle unit 10 which is provided above the wash bowl 62 and is provided with the air outlet 11 to blow air out in the blowing direction D1 toward the inner surface 62s of the wash bowl 62; the blower 20 which supplies air to be blown out of the air outlet 11 to the nozzle unit 10; the distance detection means 30 which detects the distance L1 between the object BD disposed apart from the air outlet 11 in the blowing direction D1 and the nozzle unit 10; the hand detection means 40 which detects whether or not there is a hand being placed between the object BD and the nozzle unit 10; and the control unit 50 which sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30 and drives the blower 20 in a case in which the hand detection means 40 has detected a hand. The rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is less than the first distance is less than the rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is equal to the first distance.

[0053] Owing to such a configuration, the rotational speed of the blower 20 for the blower 20 to be driven in a case in which the hand detection means 40 has detected a hand is set of the basis of the distance L1 between the object BD and the nozzle unit 10, detected by the

distance detection means 30. This enables the rotational speed of the blower 20 to be changed depending on the distance L1, and the speed of the air blown out of the air outlet 11 to be changed accordingly. In addition, the rotational speed of the blower 20 that is set when the distance L1 is less than the predetermined first distance is less than the rotational speed of the blower 20 that is set when the distance L1 is equal to the first distance. Therefore, the speed of the air blown out of the air outlet 11 can be reduced when the distance L1 is smaller to provide a reduced speed at which that air impinges onto the object BD. As a result, when the air blown out of the air outlet 11 directly impinges on the object BD, water remaining on the object BD can be prevented from splashing to the surroundings, wherein such splash of water would be caused by this air impingement, thereby making it possible to avoid making the user uncomfortable. Moreover, since the control unit 50 automatically sets the rotational speed of the blower 20 based on the distance L1 detected by the distance detection means 30, it is possible to eliminate any work of setting the rotational speed of the blower 20 performed by the installer or the like in consideration of the depth of the wash bowl 62, and can thus increase the efficiency of work.

[0054] In addition, a method for controlling the hand dryer device 1 according to the present embodiment is a method for controlling the hand dryer device 1 that includes the nozzle unit 10 provided with the air outlet 11 to blow air out in the blowing direction D1 that has been preset, the blower 20 which supplies air to be blown out of the air outlet 11 to the nozzle unit 10, the distance detection means 30, the hand detection means 40, and the control unit 50, wherein the method includes a step of detecting, by the distance detection means 30, the distance L1 between the object BD disposed apart from the air outlet 11 in the blowing direction D1 and the nozzle unit 10, a step of setting the rotational speed of the blower 20 by the control unit 50 based on the distance L1 detected by the distance detection means 30, a step of detecting, by the hand detection means 40, whether or not there is a hand being placed between the object BD and the nozzle unit 10, and a step of driving the blower 20 at the set rotational speed by the control unit 50 in a case in which the hand detection means 40 has detected a hand. The rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is less than the first distance is less than the rotational speed of the blower 20 that is set when the distance L1 detected by the distance detection means 30 is equal to the first distance.

[0055] By virtue of this method, the blower 20 of the hand dryer device 1 is driven at the rotational speed that has been set based on the distance L1 between the object BD and the nozzle unit 10 detected by the distance detection means 30 when the hand detection means 40 detects a hand. That is, the rotational speed of the blower 20 is changed depending on the distance L1 between the object BD and the nozzle unit 10, and the speed of the air blown out of the air outlet 11 is changed accordingly. In addition, the rotational speed of the blower 20 that is set when the distance L1 is less than the predetermined first distance is less than the rotational speed of the blower 20 that is set when the distance L1 is equal to the first distance. Accordingly, it is possible to reduce the speed at which the air blown out of the air outlet 11 impinges on the object BD such as, for example, the wash bowl 62 or certain water stored in the wash bowl 62, where the distance L1 is smaller. By such a possibility, when the air blown out of the air outlet 11 impinges on the object BD, water drops can be prevented from splashing from the object BD, though the splash of the water drops may be caused by this impinging air, thereby making it possible to avoid making the user uncomfortable.

[0056] Although the foregoing description has been directed to a case in which the control unit 50 sets the rotational speed of the blower 20 based on comparison of the distance L1 detected by the distance detection means 30 with the first distance, the rotational speed of the blower 20 may be set, for example, based on a table illustrated in FIG. 7. FIG. 7 is a table illustrating an example of the relationship between the distance L1 between the object BD and the nozzle unit 10 and the rotational speed of the blower 20. The table illustrated in FIG. 7 is stored in advance in the storage unit 53 of the control unit 50. The control unit 50 looks up the table illustrated in FIG. 7 based on the distance L1 detected by the distance detection means 30, and sets the rotational speed of the blower 20. For example, in a case in which the distance L1 is greater than or equal to 200 mm, the rotational speed of the blower 20 is set to a rotational speed N1 that is a high speed. In a case in which the distance L1 is greater than or equal to 100 mm and less than 200 mm, the rotational speed of the blower 20 is set to a rotational speed N2 that is a middle speed. In a case in which the distance L1 is less than 100 mm, the rotational speed of the blower 20 is set to a rotational speed N3 that is a low speed. It is noted here that there is a relationship of rotational speed N1 > rotational speed N2 > rotational speed N3. In addition, the rotational speed N1, the rotational speed N2, and the rotational speed N3 are each set to a rotational speed of the blower 20 such that when the air blown out of the air outlet 11 impinges onto the object BD, such impinging air has a speed that is low enough not to cause any splash of the water drops remaining on the object BD, in accordance with the distance L1.

[0057] Alternatively, the rotational speed of the blower 20 can also be set based on a table illustrated in FIG. 8 instead of the table illustrated in FIG. 7. FIG. 8 is a table illustrating an example of the relationship between a dimensionless distance L0 and the rotational speed of the blower 20. Note that the dimensionless distance L0 is calculated by a formula (Distance L1 - Distance L2)/Distance L2. As illustrated in FIG. 1, the distance L2 is a distance between a rim 62r of the wash bowl 62 and the nozzle unit 10 in the blowing direction D1. More specifi-

cally, the distance L2 is a distance between an intersection point of a virtual plane P1 including the top end surface of the rim 62r of the wash bowl 62 and the blowing direction D1, and the nozzle unit 10 in the blowing direction D1. For example, the distance L2 is measured in advance, and is stored in the storage unit 53 of the control unit 50. The control unit 50 calculates the dimensionless distance L0 using the distance L1 detected by the distance detection means 30 and the distance L2 stored in the storage unit 53.

[0058] In this case, the control unit 50 calculates the dimensionless distance L0 based on the distance L1 detected by the distance detection means 30, looks up the table illustrated in FIG. 8, and sets the rotational speed of the blower 20. For example, in a case in which the dimensionless distance L0 calculated from the distance L1 is greater than or equal to 1.0, the rotational speed of the blower 20 is set to the rotational speed N1, which is a high speed. In a case in which the dimensionless distance L0 calculated from the distance L1 is greater than or equal to 0.5 and less than 1.0, the rotational speed of the blower 20 is set to the rotational speed N2, which is a middle speed. In a case in which the dimensionless distance L0 calculated from the distance L1 is less than 0.5, the rotational speed of the blower 20 is set to the rotational speed N3, which is a low speed.

[0059] Note that the foregoing description has been directed to an example in which a value of the rotational speed of the blower 20 is set stepwise with respect to the distance L1 detected by the distance detection means 30, but the present invention is not limited to this example. The rotational speed of the blower 20 may be set in a continuous manner in accordance with the distance L1. For example, the rotational speed of the blower 20 may be set to have a lower value with decrease in the distance L1 detected by the distance detection means 30. Such setting will also provide an advantage similar to the advantage of the foregoing configurations.

[0060] Moreover, regarding the distance L2 described above, for example, in a case in which the washstand has the rim 62r of the wash bowl 62 is situated in a lower position than the top surface of the counter unit 63 and the rim 62r of the wash bowl 62 is covered with a circumferential portion of an opening part of the counter unit 63, use may be made of a distance between the circumferential portion of the opening part of the counter unit 63, instead of the rim 62r of the wash bowl 62, and the nozzle unit 10 in the blowing direction D1, as the distance L2. In this case, more specifically, the distance L2 corresponds to a distance between the intersection point of a virtual plane including the top surface of the circumferential portion of the opening part of the counter unit 63 and the blowing direction D1, and the nozzle unit 10 in the blowing direction D1.

[0061] Another example of how to measure the distance L1 and the distance L2 will now be described. FIG. 9 is a schematic sectional side view of a washstand 60A that is another washstand according to the present embodiment. A body unit 12A of a hand dryer device 1A illustrated in FIG. 9 is disposed to stand on the counter unit 63, and is bent toward the wash bowl 62 to extend obliquely upward. Unlike the blowing direction D1 illustrated in FIG. 1, which is an almost vertical downward direction, a blowing direction D1A of an air outlet 11A of a nozzle unit 10A included in the body unit 12A is, as illustrated in FIG. 9, an oblique downward direction toward the inner surface 62s of the wash bowl 62. In this case, the distance L1 between the object BD and the nozzle unit 10A along the blowing direction D1A is as illustrated in FIG. 9. In addition, the distance L2 between the rim 62r of the wash bowl 62 and the nozzle unit 10A in the blowing direction D1A, which is to be used in calculation of the dimensionless distance L0, is as illustrated in FIG. 9.

[0062] In the present embodiment, the air outlet 11 of the nozzle unit 10 is formed, as described above, in a long, narrow slit shape. This configuration results in a reduced size of the potential core of the airflow blown out of the air outlet 11, and the speed of the airflow is easier to decrease as the distance from the air outlet 11 is increased. Therefore, the wind speed when the airflow impinges on the object BD after the user finished drying a hand and disengaged the user's hand therefrom can be reduced while a wind speed is ensured that is sufficiently high to scatter water drops adhering to the hand at the position where the user's hand is placed. This can make it even less likely to cause a splash of the water drops remaining on the object BD, and can thus provide hygienic use.

[0063] In addition, the hand detection means 40 is disposed, as described above, adjacent to the air outlet 11 on the opposite side of the distance detection means 30 in the nozzle unit 10, and as illustrated in FIG. 2, disposed adjacent to the air outlet 11 on the side farther from the water discharge unit 61. Since the body unit 12 in which the nozzle unit 10 is formed is placed side-by-side with the water discharge unit 61, such an undesired situation may be caused that the hand detection means 40 detects a hand thereby causing a high-speed airflow to blow out of the air outlet 11 of the nozzle unit 10 when a user moves her or his hand to under the water discharge unit 61 to wash the hand and the hand comes under a part of a space under the nozzle unit 10. In this case, simultaneous discharge of some water from the water discharge unit 61 and a high-speed airflow from the air outlet 11 may be caused and thereby the water discharged from the water discharge unit 61 may be splashed due to the high-speed airflow. As described above, the arrangement of the hand detection means 40 disposed distant from the water discharge unit 61 in the nozzle unit 10 can decrease the possibility that a user's hand will unintentionally enter the detection range of the hand detection means 40, thereby making it possible to prevent simultaneous discharge of the water and the high-speed airflow.

[0064] In the present embodiment, the blower 20 and

the control unit 50 are disposed inside the power block case 21, the power block case 21 is disposed under the counter unit 63, and the body unit 12 having the nozzle unit 10 formed therein is disposed above the counter unit 63. In this manner, installation of the power block case 21 housing the blower 20 and the control unit 50 under the counter unit 63 can make smaller the space to be occupied by the hand dryer device 1 above the counter unit 63, and can ensure a wider space usable by the user above the counter unit 63, thereby enabling usability to be improved. In addition, because the user cannot see the blower 20 and the like, a design quality can be improved.

[0065] Note that the configuration is not limited to the foregoing arrangement, but, for example, the nozzle unit 10 and the blower 20 may be disposed in a single housing, and this housing may be disposed above the counter unit 63. In addition, despite the above-description having been given for the control unit 50 disposed inside the power block case 21, the control unit 50 may be disposed outside the power block case 21.

[0066] In the present embodiment, the water discharge unit 61 is configured to discharge water in conjunction with a sensor that detects a user's hand, but the present invention is not limited to this example. The water discharge unit 61 may be configured to discharge water in conjunction with a manual operation of a faucet lever or the like. In addition, despite the above-description having been given for the wash bowl 62 provided separately from the counter unit 63, the wash bowl 62 may be formed integrally with the counter unit 63. The wash bowl 62 may have any shape, without particular limitation, as long as the shape can receive the water discharged from the water discharge unit 61 on its inner surface 62s.

[0067] Although the body unit 12 of the hand dryer device 1 has been described as being disposed to stand from the counter unit 63, the present invention is not limited to this example. For example, the body unit 12 may be configured to be supported by the wall WL, and provided to extend toward the wash bowl 62 from the wall WL.

[0068] The distance detection means 30 has been described as using an optical distance sensor, but the present invention is not limited to this example, and another type of distance sensor may be used. In addition, the distance detection means 30 has been described as being disposed in the nozzle unit 10, but the present invention is not limited to this example. The distance detection means 30 may be disposed separately from the nozzle unit 10 as long as it can detect the distance between the object BD and the nozzle unit 10. Although the distance detection means 30 detects the distance L1 between the object BD and the nozzle unit 10, this detection covers not only direct detection but also indirect detection. For example, the distance detection means 30 may detect the distance L1 between the object BD and the nozzle unit 10 by means of detecting a different distance and geometrically converting this distance, or some other means like that.

[0069] Although the hand detection means 40 has been described as using an infrared sensor or a distance sensor, the present invention is not limited to this example. For example, as the hand detection means 40, a capacitive sensor may be used. In addition, although the distance detection means 30 and the hand detection means 40 have been described as being provided separately, the present invention is not limited to this manner. A single sensor may have both functionalities of the distance detection means 30 and the hand detection means 40. As such a sensor, an optical distance sensor can be used, for example. In this case, in consideration of a situation where the user's hand is usually positioned near the nozzle unit 10 having the air outlet 11 blowing air provided therein, what the distance sensor has detected within a range of a predetermined distance from the nozzle unit 10 is determined to be a hand or hands, but what the distance sensor has detected at a position remoter than the position far from the nozzle unit 10 by the predetermined distance is determined to be the object BD, thereby detection of the distance between the object BD and the nozzle unit 10 being able to be distinguished from detection of the hand.

Second Embodiment.

[0070] A second embodiment of this invention will next be described with reference to FIG. 10. FIG. 10 is a bottom view of a nozzle unit 110 of a hand dryer device 101 according to the present embodiment. Note that description of elements of the present embodiment that are similar to the corresponding elements of the first embodiment will be omitted.

[0071] The nozzle unit 110 has an air outlet 111 provided therein. Unlike the air outlet 11 formed in a slit shape in the first embodiment, the air outlet 111 has a configuration, as illustrated in FIG. 10, such that multiple round holes are linearly arranged in the present embodiment. The multiple round holes are arranged in a single line in the direction in which the end portion of the body unit 12 extends. The diameter of each round hole is set to, for example, 2 mm or less. In addition, a hand detection means 140 is disposed on a side of the front end of the air outlet 111 in the nozzle unit 110. That is, the hand detection means 140 is set at the position nearer to a possible user in the nozzle unit 110. Such arrangement improves accuracy of detection of a hand in the hand detection means 140, and can thus improve comfort of use of the user.

[0072] Preferred embodiments of the present invention have been described above, but the present invention is not necessarily limited to these embodiments. Any addition, omission, substitution, and any other modification of the configuration may be realized without departing from the spirit of the present invention.

Industrial Applicability

[0073] The hand dryer device, the washstand with a hand dryer device, and the method for controlling a hand dryer device described above can prevent the water remaining on the object such as a wash bowl disposed apart from the air outlet, from being splashed to the surroundings due to the blown air, and can thus avoid making the user uncomfortable.

Reference Signs List

[0074] 1, 1A, 101 hand dryer device; 10, 10A, 110 nozzle unit; 11, 11A, 111 air outlet; 12, 12A body unit; 13 air-blow duct; 20 blower; 21 power block case; 30 distance detection means; 40 hand detection means; 50 control unit; 51 distance determination unit; 52 operation control unit; 53 storage unit; 60, 60A washstand; 61 water discharge unit; 62 wash bowl; 62r rim; 62s inner surface; 63 counter unit; 64 box-shaped body; 65 drain outlet; 66 drainpipe; 67 drain stopper; 71 processor; 72 memory; BD object; D1, D1A blowing direction; FL floor; L0 dimensionless distance; L1, L2 distance; N1, N2, N3 rotational speed; P1 virtual plane; WL wall.

Claims

1. A hand dryer device comprising:

a nozzle unit having an air outlet to blow air out in a blowing direction that has been preset;
a blower to supply air to be blown out of the air outlet to the nozzle unit;
a distance detection means to detect a distance between an object and the nozzle unit, the object being disposed apart from the air outlet in the blowing direction;
a hand detection means to detect whether or not there is a hand being placed between the object and the nozzle unit; and
a control unit to set a rotational speed of the blower based on the distance detected by the distance detection means, and drive the blower when the hand detection means detects a hand, wherein
a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

2. The hand dryer device according to claim 1, wherein the control unit sets the rotational speed of the blower to a first rotational speed when the distance detected by the distance detection means is greater than or equal to the first distance, and sets the rotational speed of the blower to a rotational speed less than the first rotational speed when the distance detected by the distance detection means is less than the first distance.

3. The hand dryer device according to claim 1, wherein the rotational speed of the blower is set to a lower value with decrease in the distance detected by the distance detection means.

4. The hand dryer device according to any one of claims 1 to 3, wherein the control unit sets the rotational speed of the blower based on the distance detected by the distance detection means when the hand detection means does not detect a hand.

5. The hand dryer device according to any one of claims 1 to 4, wherein the distance detection means is disposed adjacent to the air outlet in the nozzle unit.

6. A washstand with a hand dryer device, comprising:

a water discharge unit to discharge water;
a wash bowl having an inner surface to receive the water discharged from the water discharge unit;
a nozzle unit that is provided above the wash bowl, and has an air outlet to blow air out in a blowing direction directed to the inner surface of the wash bowl;
a blower to supply air to be blown out of the air outlet to the nozzle unit;
a distance detection means to detect a distance between an object and the nozzle unit, the object being disposed apart from the air outlet in the blowing direction;
a hand detection means to detect whether or not there is a hand being placed between the object and the nozzle unit; and
a control unit to set a rotational speed of the blower based on the distance detected by the distance detection means, and drive the blower when the hand detection means detects a hand, wherein
a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

7. A method for controlling a hand dryer device including a nozzle unit having an air outlet to blow air out in a blowing direction that has been preset, a blower to supply air to be blown out of the air outlet to the nozzle unit, a distance detection means, a hand detection means, and a control unit, the method comprising:

a step of detecting a distance between an object and the nozzle unit by the distance detection means, the object being disposed apart from the air outlet in the blowing direction;

a step of setting a rotational speed of the blower by the control unit based on the distance detected by the distance detection means;

a step of detecting, by the hand detection means, whether or not there is a hand being placed between the object and the nozzle unit; and

a step of driving the blower by the control unit at the set rotational speed, when the hand detection means detects a hand, wherein

a rotational speed of the blower that is set when the distance detected by the distance detection means is less than a first distance is less than a rotational speed of the blower that is set when the distance detected by the distance detection means is equal to the first distance.

FIG.1

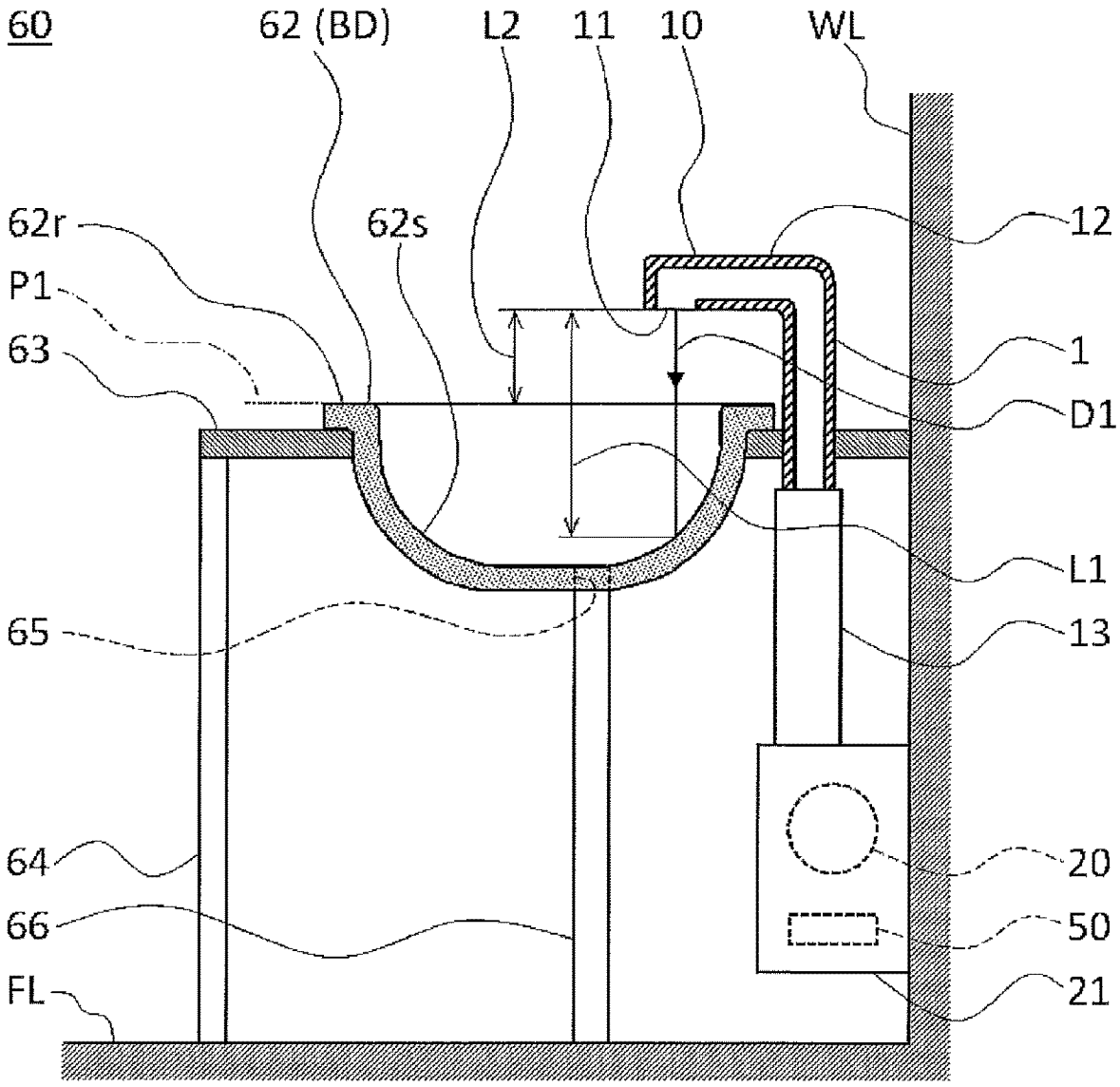


FIG.2

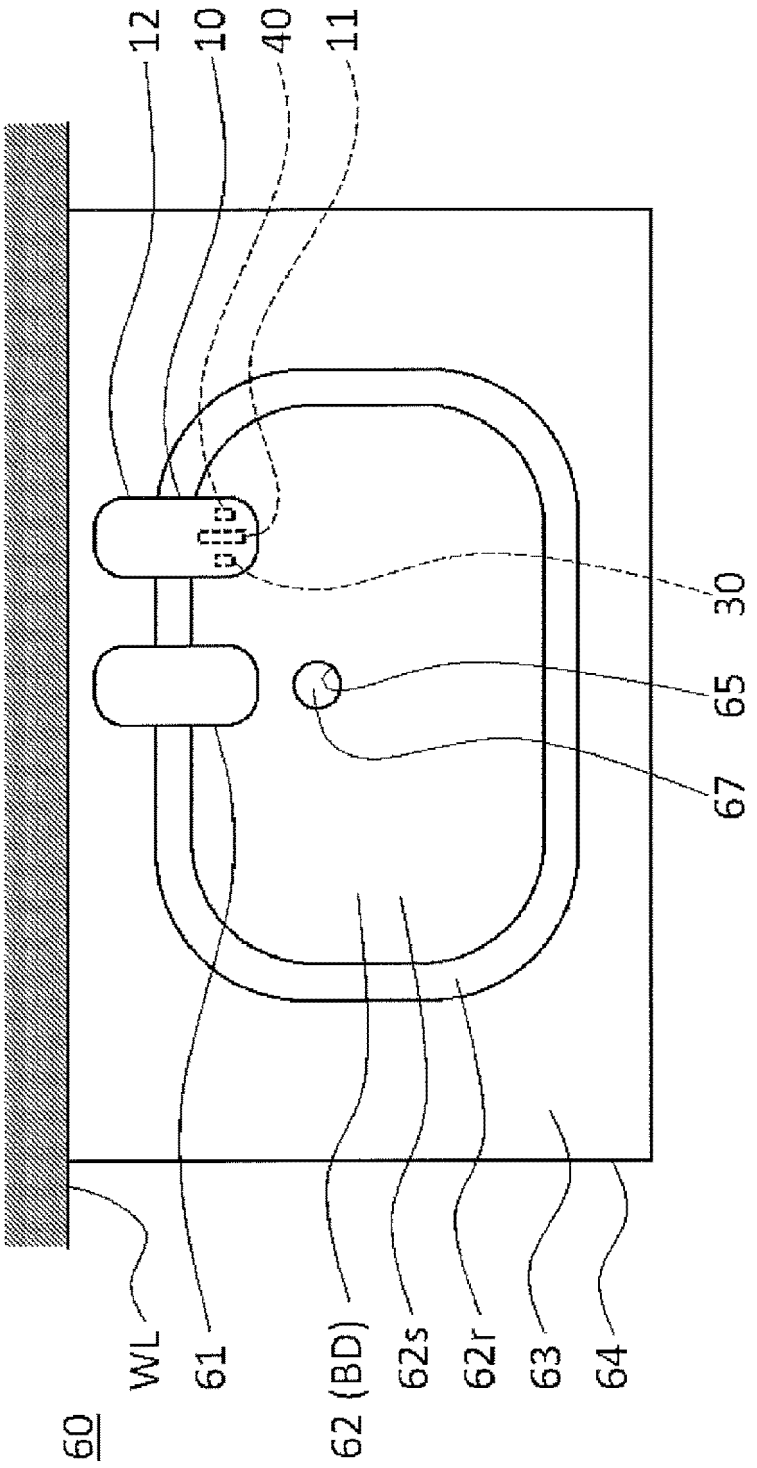


FIG.3

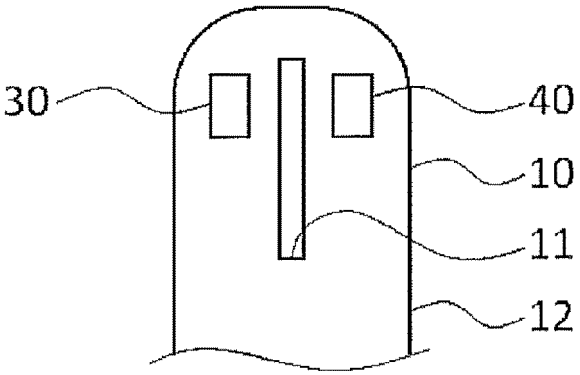


FIG.4

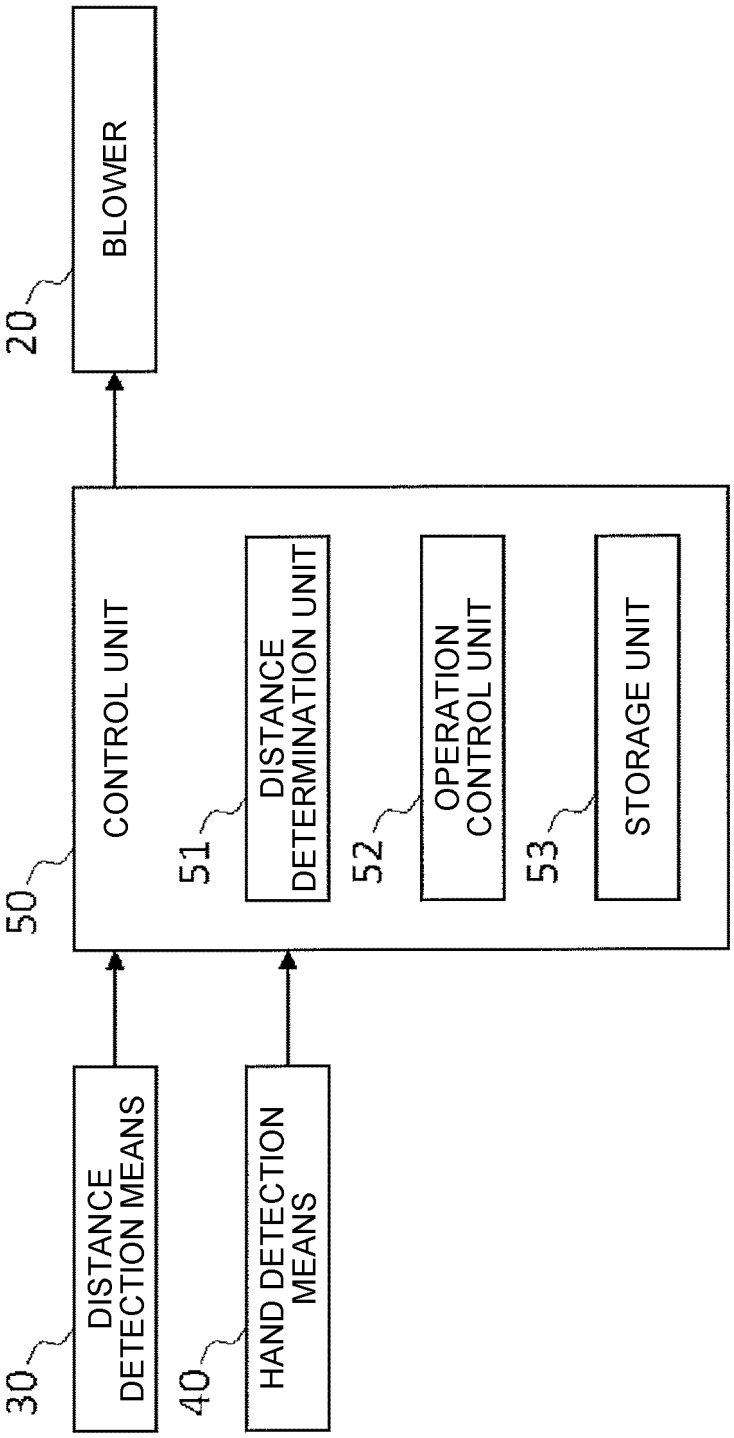

BLOWER
20
CONTROL UNIT
50
DISTANCE DETERMINATION UNIT
51
OPERATION CONTROL UNIT
52
STORAGE UNIT
53
DISTANCE DETECTION MEANS
30
HAND DETECTION MEANS
40

FIG.5

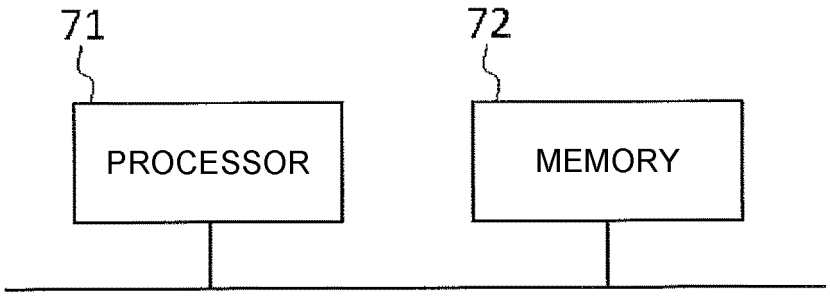


FIG.6

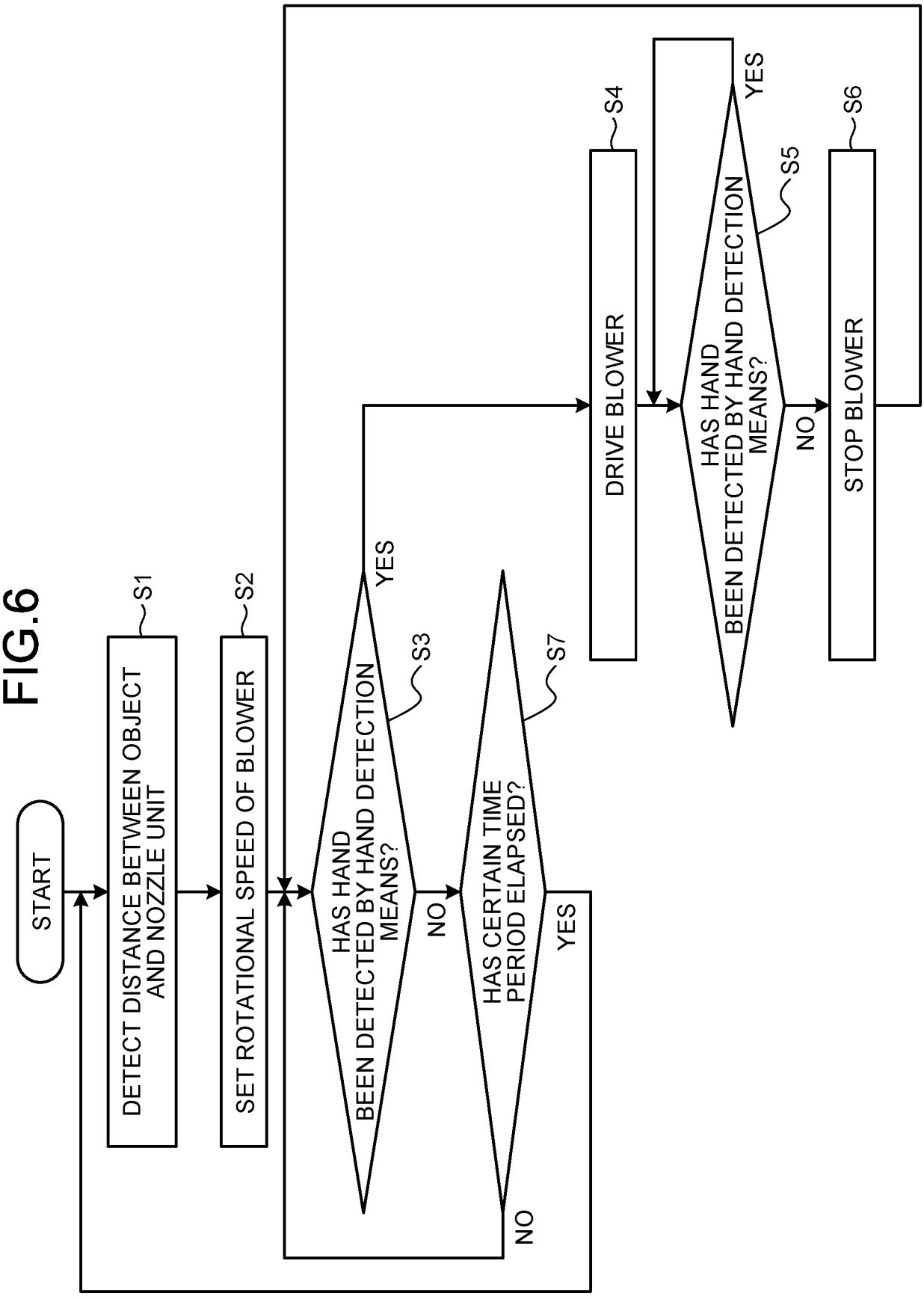

START
DETECT DISTANCE BETWEEN OBJECT AND NOZZLE UNIT
S1
SET ROTATIONAL SPEED OF BLOWER
S2
HAS HAND BEEN DETECTED BY HAND DETECTION MEANS?
S3
YES
NO
HAS CERTAIN TIME PERIOD ELAPSED?
S7
YES
NO
DRIVE BLOWER
S4
HAS HAND BEEN DETECTED BY HAND DETECTION MEANS?
S5
YES
NO
STOP BLOWER
S6

FIG.7

DISTANCE L1 BETWEEN OBJECT BD AND NOZZLE UNIT 10	ROTATIONAL SPEED OF BLOWER 20
200 mm OR GREATER	HIGH SPEED (ROTATIONAL SPEED N1)
100 mm OR GREATER, LESS THAN 200 mm	MIDDLE SPEED (ROTATIONAL SPEED N2)
LESS THAN 100 mm	LOW SPEED (ROTATIONAL SPEED N3)

FIG.8

DIMENSIONLESS DISTANCE L0	ROTATIONAL SPEED OF BLOWER 20
1.0 OR GREATER	HIGH SPEED (ROTATIONAL SPEED N1)
0.5 OR GREATER, LESS THAN 1.0	MIDDLE SPEED (ROTATIONAL SPEED N2)
LESS THAN 0.5	LOW SPEED (ROTATIONAL SPEED N3)

FIG.9

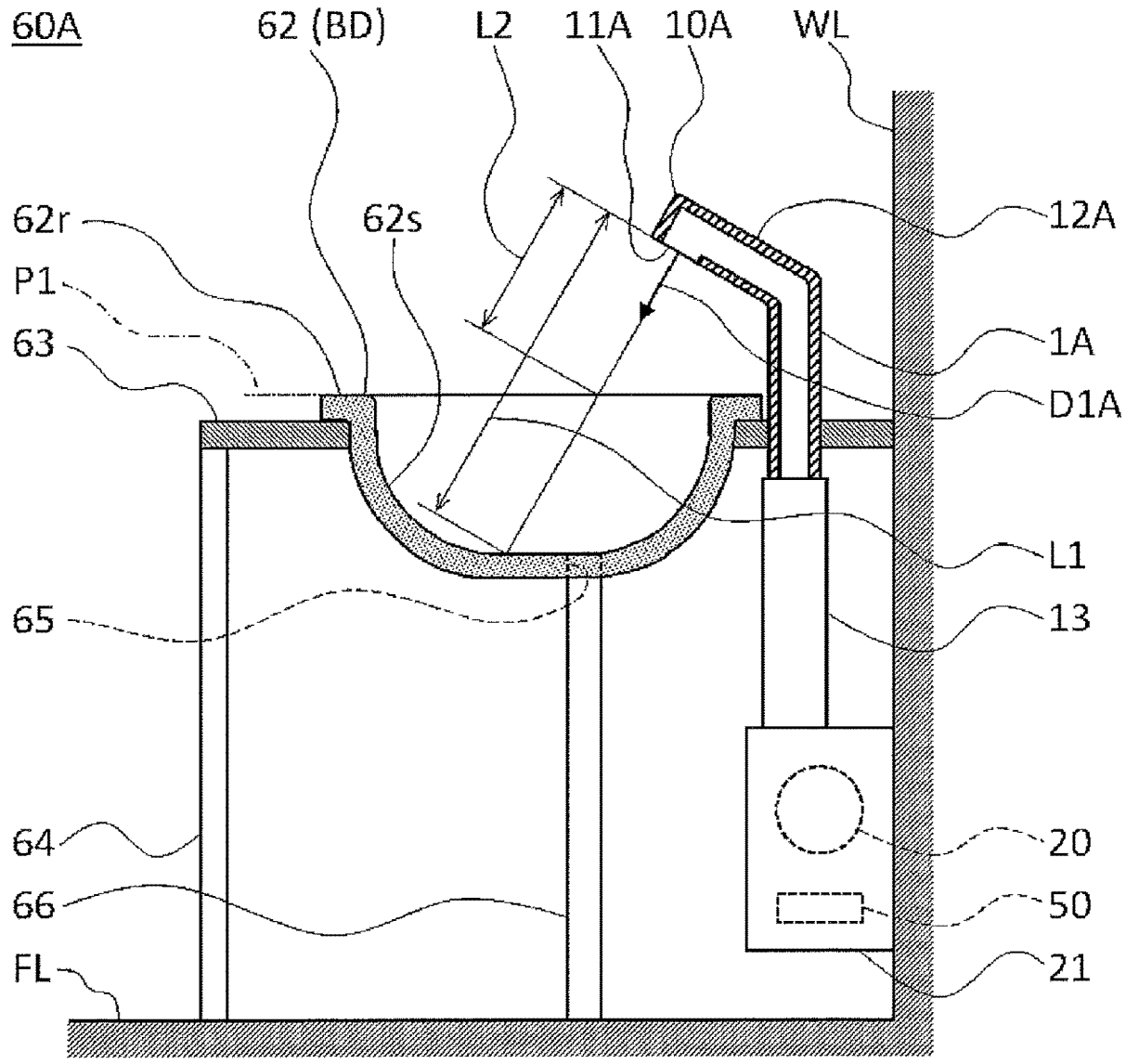
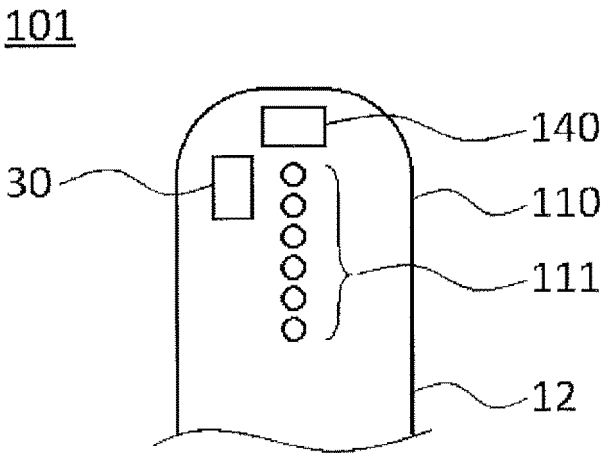

60A
62 (BD)
L2
11A
10A
WL
62r
62s
12A
P1
63
1A
D1A
L1
65
13
64
20
66
50
FL
21

FIG.10



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/027494

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl. A47K10/48(2006.01)i, A47K1/00(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)
Int.Cl. A47K10/48, A47K1/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2019
Registered utility model specifications of Japan	1996-2019
Published registered utility model applications of Japan	1994-2019

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 A	JP 2014-50473 A (MITSUBISHI ELECTRIC CORPORATION) 20 March 2014, paragraphs [0016]-[0018], fig. 1-4 (Family: none)	1, 4-7 2, 3
Y A	JP 2010-77653 A (PANASONIC ELECTRIC WORKS CO., LTD.) 08 April 2010, paragraphs [0011]-[0016], fig. 1 (Family: none)	1, 4-7 2, 3

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

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
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"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
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"&" document member of the same patent family

Date of the actual completion of the international search 04.09.2019	Date of mailing of the international search report 17.09.2019
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2019/027494

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 1-214320 A (KOITO INDUSTRIES, LTD.) 28 August 1989, page 3, upper left column, line 11 to upper right column, line 12, fig. 1, 3 (Family: none)	1-7

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008272086 A **[0003]**