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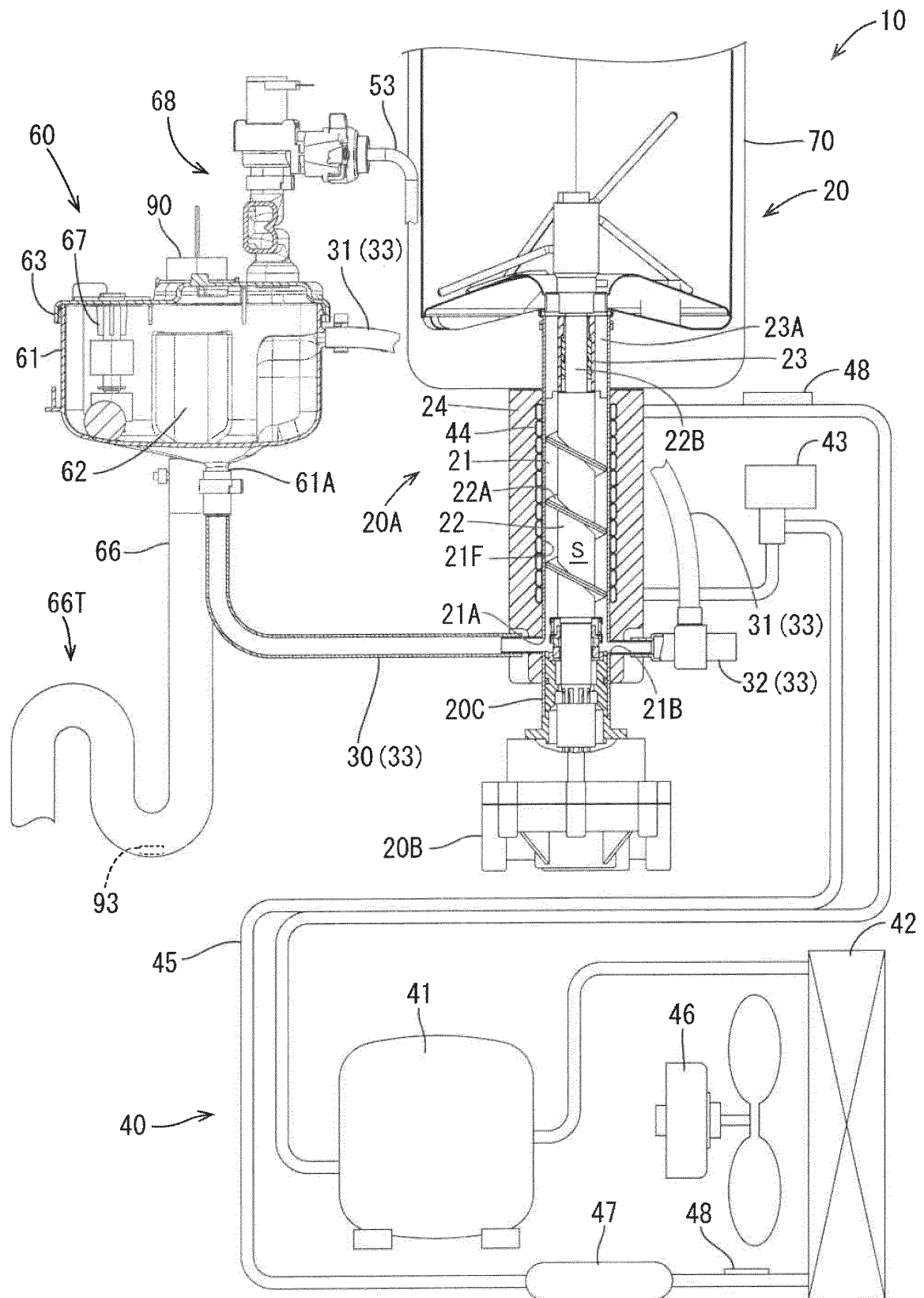
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(54) **ICE MAKING MACHINE**

(57) An ice making machine 10 includes a water tank 60, an ice making section 20, and a UV sterilization device 90. The water tank 60 includes an introduction section 68 via which water flows into the tank and an outlet section 61A via which the water flows out from the tank. The water tank 60 stores the water therein. The ice making section 20 is configured to freeze the water flowing

out via the outlet section 61A and make ice. The UV sterilization device 90 irradiates ultraviolet light to the water and sterilize the water. The UV sterilization device 90 is disposed such that an ultraviolet light irradiation range of the UV sterilization device includes at least a flowing path of the water that flows into the tank via the introduction section 68.

FIG.3



Description

[Patent Document 4] Japanese Unexamined Patent
Application Publication No. 2020-20562

TECHNICAL FIELD

[0001] The technology described herein relates to an ice making machine.

BACKGROUND ART

[0002] An ice making machine described in Patent Document 1 has been known. The ice making machine includes an evaporator including an evaporator plate, a distributor, a sump, a pump, and an ice chute. The distributor distributes water to the evaporator plate to make ice. The sump receives the water from the distributor and water from a water source. The pump supplies water from the sump to the distributor. The ice chute receives ice pieces. Patent Document 1 describes that the ice making machine is provided with micro-biological control that is performed with film filtration, silver ions, antibacterial agent, ozone or any combination thereof.

[0003] An ice making machine in which ice made by an ice making mechanism is stored in an ice storage room has been known. For example, Patent Documents 2 and 3 disclose an ice making machine including an ultraviolet light irradiation device. By irradiating ultraviolet light to an ice making water tank or the ice storage room, the ice making machine and ice made by the ice making machine can be kept clean. Patent Document 3 describes that the ultraviolet light irradiation device is controlled to perform ultraviolet light irradiation when the ice making machine operates in a specific operation mode.

[0004] An ice dispenser described in the third embodiment of Patent Document 4 has been known as another example of ice making machines. The ice dispenser includes an ice storage room and an ultraviolet light irradiation device. The ice storage room stores ice therein and includes an outlet through which the ice stored in the ice storage room is dispensed. The ultraviolet light irradiation device is disposed adjacent to the outlet and irradiates ultraviolet light to a water transfer path including the outlet for sterilization. Accordingly, the ice and water dispensed with the ice can be kept clean.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005]

[Patent Document 1] Japanese Unexamined Patent
Application Publication No. 2016-6376

[Patent Document 2] Japanese Unexamined Patent
Application Publication No. 2019-219095

[Patent Document 3] Japanese Unexamined Patent
Application Publication No. 2020-020562

SUMMARY OF THE PRESENT INVENTION

Problem to be Solved by the Invention

[0006] However, the ice making machine described in Patent Document 1 is for coping with problems caused by entering of bacteria (microorganism) from an outside but not for suppressing bacterial growth inside the ice making machine, for example, inside the sump, a path along which the produced ice moves, and a storage space in which the produced ice is stored.

[0007] An ultraviolet light irradiation device including ultraviolet light emitting diodes (UV-LEDs) as an ultraviolet light source has been recently used instead of including the discharge lamps such as mercury lamps and metal halide lamps as the ultraviolet light source. A life span of the ultraviolet light source that is widely used for sterilization is about ten to twenty thousand hours of an irradiation time with using the UV-LED that usually has a longer life span than the discharge lamp. However, such a life span of the widely-used ultraviolet light source is extremely shorter than the life span of the ice making machine, which is about five to ten years. As described in Patent Document 3, with the ultraviolet light irradiation device irradiating ultraviolet light only in the specific operation mode, the operation time of the ultraviolet light irradiation device can be shortened and the life span of the ultraviolet light irradiation device can be maintained long; however, the sterilizing effects cannot be obtained while the ultraviolet light irradiation being not performed.

[0008] To provide drink or food with high safety, it is effective to sterilize the drink or food that is dispensed through the outlet. However, the drink or food is provided right after being dispensed through the outlet and therefore, quite strong ultraviolet light needs to be irradiated to the drink or food for sterilization. The ultraviolet light irradiation device of the ice dispenser described in Patent Document 4 always irradiates a constant amount of ultraviolet light for sterilization of the ice and water transfer path and does not include control means for controlling irradiation intensity of ultraviolet light according to usage. A great amount of energy is required to irradiate ultraviolet light of a high intensity all the time and this is not realistic.

[0009] The technology described herein has been made in view of the aforementioned circumstances. An object of the present technology is to provide an ice making machine that can make sanitary ice with suppressing bacterial growth. Another object is to provide an ice making machine that can keep the ice making machine and ice clean and have a longer life span with effectively using an ultraviolet light irradiation device. Another object is to provide an ice making machine that can supply drink or food with high safety.

Means for Solving the Problem

[0010] An ice making machine according to the present disclosure includes a tank, an ice making section, and a UV sterilization device. The tank includes an introduction section via which water flows into the tank and an outlet section via which the water flows out from the tank and the tank stores the water therein. The ice making section is configured to freeze the water that flows out via the outlet section and make ice. The UV sterilization device irradiates ultraviolet light to the water and sterilize the water. The UV sterilization device is disposed such that an ultraviolet light irradiation range of the UV sterilization device includes at least a flowing path of the water that flows into the tank via the introduction section.

[0011] According to such an ice making machine, water flowing from the introduction section and stored in the tank is sterilized with the ultraviolet light irradiated by the UV sterilization device on the flowing path from the introduction section. Therefore, water stored in the tank can be effectively sterilized and kept clean inside the tank. The water sterilized and stored in the tank in a clean manner can flow through the outlet section of the tank to the ice making section. Therefore, sanitary ice can be produced in the ice making section.

[0012] In the above configuration, the tank may include a storing section storing the water and a discharge section discharging water that overflows from the storing section to outside of the storing section. The discharge section may be configured not to block ultraviolet light irradiated by the UV sterilization device toward the storing section. According to such an ice making machine, the storing section includes no portions (shadows of the discharge section are not created) that the ultraviolet light is blocked by the discharge section. Therefore, bacterial growth is prevented in the storing section.

[0013] In the above configuration, the tank may include a bottom portion including a bottom surface, the outlet section may be included in the bottom portion, the bottom portion may be inclined downward as it extends toward the outlet section, and the UV sterilization device may be mounted on a portion of the bottom portion adjacent to the outlet section. According to such an ice making machine, the UV sterilization device is likely to irradiate ultraviolet light toward a whole inner surface of the inner walls of the tank from the water adjacent to the outlet section. Therefore, the water stored in the tank and the inner walls of the tank can be effectively kept clean.

[0014] In the above configuration, the tank may include a protruded portion that protrudes inward, and the protruded portion may have a top portion that is opposite the introduction section and has a tapered shape. According to such an ice making machine, water flowing from the introduction section hits the top portion and is stored in the tank quietly. Therefore, a ripple is less likely to be created on a surface of the water stored in the tank and the water flowing into the tank is less likely to splash and water droplets are less likely to stick to the UV ster-

ilization device. Ultraviolet light is less likely to inappropriately hit the water and the sterilizing effects is less likely to be lowered.

[0015] In the above configuration, the introduction section may include an introduction opening that opens inside the tank and a flow cavity in which water from outside of the tank flows toward the introduction opening, and the flow cavity may be bent at a portion adjacent to the introduction opening. According to such an ice making machine, with the water flowing with winding in the portion of the flow cavity close to the introduction opening, a flowing speed of water is decreased and the water is less likely to flow into the tank with great force. Therefore, a ripple is less likely to be created on a surface of the water stored in the tank and the water flowing into the tank is less likely to splash and water droplets are less likely to stick to the UV sterilization device. Ultraviolet light is less likely to inappropriately hit the water and the sterilizing effects are less likely to be lowered.

[0016] In the above configuration, the ice making machine may further include a circulation mechanism with which water flowing out from the outlet section into the ice making section via a supply cavity is transferred to the tank again via a cavity that is different from the supply cavity by driving by a pump and a control section configured to control driving of the pump according to ultraviolet light irradiation by the UV sterilization device. According to such an ice making machine, the water circulating through the tank and the ice making section can be effectively sterilized by the UV sterilization device. Further, the UV sterilization device and the pump can be activated efficiently and the life span of the devices can be increased.

[0017] In the above configuration, the ice making machine may further include a visible light irradiation device emitting visible light according to ultraviolet light irradiation by the UV sterilization device and a visible check portion with which the visible light emitted by the visible light irradiation device can be seen. According to such an ice making machine, a user can easily check the operation of the UV sterilization device from the outside without taking the tank into pieces. A user is not exposed with ultraviolet light irradiated by the UV sterilization device. Accordingly, ice making water that can be used safely can be provided.

[0018] In the above configuration, the tank may include a storing section storing the water and a discharge section discharging water that overflows from the storing section to outside of the storing section, the discharge section may include a trap that temporally stores the water discharged via the discharge section, and a trap-side UV sterilization device that irradiates ultraviolet light to water and sterilizes the water may be disposed in the trap. With the discharge section including the trap, bacteria may grow in the trap and a muddy object may be stuck in the flowing path of water flowing in the trap. However, with the above ice making machine, the bacterial growth in the discharge section is prevented and clogging

of the path in the trap is preferably suppressed.

[0019] An ice making machine according to the present disclosure includes an ice making section, an ice tank, a transfer cavity, and a UV sterilization device. The ice making section is configured to freeze water and make ice. The ice tank stores the ice therein. The transfer cavity extends from the ice making section to the ice tank and the ice moves in the transfer cavity from the ice making section into the ice tank. The UV sterilization device irradiates ultraviolet light to the ice and sterilizes the ice. The UV sterilization device is disposed such that an ultraviolet light irradiation range of the UV sterilization device includes at least a moving path of the ice that moves along the transfer cavity.

[0020] According to such an ice making machine, the ice made by the ice making section is sterilized with the ultraviolet light irradiated by the UV sterilization device on the way of moving from the ice making section to the inside of the ice tank via the transfer cavity. Accordingly, clean ice can be stored in the ice tank and supplied to a user.

[0021] In the above configuration, the transfer cavity may include an opening that opens toward inside of the ice tank, and the UV sterilization device may be arranged in the ice tank so as to be opposite the opening.

[0022] According to such an ice making machine, the ultraviolet light can be irradiated to the inside of the transfer cavity through the opening from the ice tank side. Therefore, the ice moving in the transfer cavity toward the ice tank can be effectively sterilized. In a configuration that a user takes out the ice from the ice tank with a scoop, bacterial infection is likely to be caused in the ice stored in the ice tank, the inside of the ice tank, and the transfer cavity that is continuous to the ice tank. However, with the above-described ice making machine, the ice stored in the ice tank, and the inside of the transfer cavity and the ice tank are sterilized and sanitary ice can be provided.

[0023] In the above configuration, the ice tank may include a wall having an inner surface portion that reflects ultraviolet light and the UV sterilization device may be disposed such that the ultraviolet light irradiation range includes the inner surface portion of the ice tank.

[0024] According to such an ice making machine, the ultraviolet light irradiated by the UV sterilization device reflects off the inner walls of the ice tank and reflected ultraviolet light reaches any inner portions of the ice tank. For example, in a configuration including a structure such as a spray nozzle injecting cleaning liquid in the ice tank, ultraviolet light can preferably reach a portion of the spray nozzle that is on an opposite side from the UV sterilization device.

[0025] In the above configuration, the ice making section may include an exit opening section that includes an opening through which produced ice made by the ice making section exits to the transfer cavity and the UV sterilization device may be disposed in the transfer cavity to be opposite the exit opening section. According to such

an ice making machine, ultraviolet light irradiated by the UV sterilization device travels to the inside of the ice making section through the exit opening section and the inside of the ice making section can be sterilized effectively.

[0026] In the above configuration, the exit opening section may include dividing portions that divides the produced ice and the UV sterilization device may be disposed in the transfer cavity to be opposite the dividing portions. According to such an ice making machine, ultraviolet light irradiated by the UV sterilization devices can travel through a space between the dividing portions and reach the inside of the ice making section. Thus, the inside of the ice making section can be sterilized effectively.

[0027] In the above configuration, the exit opening section may include a cutter that cuts the produced ice with being rotated and a reflection member that is mounted on the cutter and reflects ultraviolet light. According to such an ice making machine, ultraviolet light irradiated by the UV sterilization device reflects off the reflection member that rotates with the cutter and is dispersed and travels in multiple directions. Accordingly, the ultraviolet light can be supplied to a relatively large area including the exit opening section and the cavity.

[0028] In the above configuration, the transfer cavity may include a protruding portion between the UV sterilization device and the exit opening section and the protruding portion may protrude from an inner wall surface of the transfer cavity. The ice that exits through the exit opening section is broken into pieces and small broken ice pieces and water are splashed when the ice moves in the spout. According to the ice making machine described above, the protruding portion protects the UV sterilization device from the splashed small ice pieces and water. Therefore, insufficient ultraviolet light irradiation and lowering of sterilizing effects are suppressed.

[0029] In the above configuration, the exit opening section may include a gas flow opening that is an opening of a gas flow cavity, and the UV sterilization device may be disposed in the transfer cavity to be opposite the gas flow opening. The ice making machine may include a gas flow cavity in which gas flows between the ice making section and the flow cavity in addition to a cavity in which ice is transferred from the ice making section to the flow cavity. Bacteria may be caused in the gas flow cavity. However, according to the ice making machine described above, ultraviolet light irradiated by the UV sterilization device preferably reaches the gas flow cavity through the gas flow opening.

[0030] In the above configuration, the transfer cavity may include an upper-bottom cavity that extends in an upper-bottom direction and in which the ice falls down from the ice making section into the ice tank, the UV sterilization device and a UV detection device may be disposed in the upper-bottom cavity, and the UV detection device may be disposed opposite the UV sterilization device and detects ultraviolet light. According to such an ice making machine, the ice that falls in the upper-bottom

cavity can be sterilized by the UV sterilization device and the falling of the ice can be detected by the UV detection device. Accordingly, it can be determined whether the ice making machine is in an abnormal state or not. For example, if ice is excessively stored in the ice tank or ice cannot fall inside the upper-bottom cavity, the ice making machine is in an abnormal state.

[0031] In the above configuration, the upper-bottom cavity may include a recessed portion that is recessed outward, and the UV sterilization device or the UV detection device may be disposed in the recessed portion. When the ice falls inside the upper-bottom cavity, small broken ice pieces and water are splashed. According to such the ice making machine described above, the splashed small ice pieces and water do not stick to the UV detection device. Therefore, ultraviolet light is less likely to be insufficiently irradiated or not to be detected by the UV detection device and operations of the devices are not hindered.

[0032] In the above configuration, an ice detection device that detects the ice stored in the ice tank may be disposed on the transfer cavity. According to such an ice making machine, it can be determined more precisely whether the ice making machine is in an abnormal state such as an excessive amount of ice stored in the ice tank.

[0033] An ice making machine according to the present disclosure includes an ice making section, an ice storing section, and a water supply and discharge mechanism. The ice making section is configured to freeze ice making water and make ice. The ice storing section stores the ice made by the ice making section. The water supply and discharge mechanism is configured to supply and discharge the ice making water to and from at least the ice making section. At least one of the ice making section, the ice storing section, and the water supply and discharge mechanism includes an ultraviolet light irradiation device that emits ultraviolet light for sterilization and a control device configured to increase and decrease an irradiation amount of ultraviolet light from the ultraviolet light irradiation device. According to such a configuration, the UV sterilization can be performed for ice making water the produced ice. Ultraviolet light is irradiated at least while the ice making operation is being performed and therefore, the UV sterilization can be maintained. Since the amount of ultraviolet light irradiated by the ultraviolet light irradiation device can be increased or decreased as necessary, the life span of the ultraviolet light irradiation device can be kept long and it is economical. This reduces necessity of maintenance.

[0034] In a preferred mode according to the technology described herein, the ultraviolet light irradiation device is included in the water supply and discharge mechanism. The water supply and discharge mechanism includes a water tank and a water supply valve. The water tank stores water to be supplied to the ice making section. The water supply valve is disposed on a water supply cavity connecting an external source and the water storing tank and is configured to be opened and closed to

supply and stop supplying water to the water tank from the external source. The control device is configured to increase the irradiation amount from the ultraviolet light irradiation device when the water supply valve is opened, and decrease the irradiation amount from the ultraviolet light irradiation device when the water supply valve is closed. According to such a configuration, when the UV sterilization is required to be performed for the water to be supplied to the water tank, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device can be appropriately controlled.

[0035] In a preferred mode according to the technology described herein, the ultraviolet light irradiation device is included in the water supply and discharge mechanism. The water supply and discharge mechanism includes a water tank and a water supply valve. The water tank stores water to be supplied to the ice making section. The water supply valve that is disposed on a water supply cavity connecting an external source and the water storing tank and is configured to be opened and closed to supply and stop supplying water to the water tank from the external source. The control device is configured to drive the ultraviolet light irradiation device with a decreased irradiation amount of ultraviolet light. When the water supply valve is closed from an open state, the control device is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device while the water supply valve is being closed. According to such a configuration, the amount of ultraviolet light to be irradiated by the ultraviolet light irradiation device can be appropriately controlled when water to be supplied to the water tank is sufficiently sterilized and the UV sterilization needs to be performed for the water that stays inside the water tank.

[0036] In a preferred mode according to the technology described herein, the external source is configured to supply purified water purified through a purifier. The control device is further configured to decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the purifier does not reach an end of a life span, and increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the purifier reaches the end of a life span. According to such a configuration, with purified water being supplied to the water tank, the irradiation amount of ultraviolet light from the ultraviolet light irradiation device can be preferably controlled with considering the life span of the purifier.

[0037] In a preferred mode according to the technology described herein, the control device is configured to increase and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device according to an installation environment of the ice making machine. According to such a configuration, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device can be appropriately controlled with considering the environment where the ice making machine is to be installed.

[0038] In a preferred mode according to the technology described herein, the control device is configured to increase and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device by controlling a current supplied to the ultraviolet light irradiation device with PWM control. According to such a configuration, the current supplied to the ultraviolet light irradiation device can be appropriately controlled with high-speed switching without changing a voltage. With LEDs (light emitting diodes) being used for the light source of the ultraviolet light irradiation device, the amount of ultraviolet light to be irradiated can be preferably controlled without changing the light emission wavelength of the LEDs.

[0039] In a preferred mode according to the technology described herein, the control device further includes a timer measuring irradiation time of ultraviolet light from the ultraviolet light irradiation device and is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device according to the irradiation time. In ultraviolet light irradiation devices, the UV irradiation amount generally decreases with the same current as the life span is close to the end. According to the above configuration, if the ultraviolet light irradiation device is close to the end of the life span, the current supplied to the ultraviolet light irradiation device can be increased to compensate for the decrease in the emission of light due to the end of the life span. As a result, a necessary amount of ultraviolet light can be irradiated appropriately even if the ultraviolet light irradiation device is close to the end of the life span.

[0040] In a preferred mode according to the technology described herein, the control device further includes a timer measuring irradiation time of ultraviolet light from the ultraviolet light irradiation device and is configured to inform that the ultraviolet light irradiation device is close to an end of a life span at a predetermined timing before the ultraviolet light irradiation device reaches the end of a life span. According to such a configuration, a user is informed of necessity of an appropriate performance such as replacement before the ultraviolet light irradiation device reaches the end of the life span. As a result, the ice making machine can be operated without causing an error in the ultraviolet light irradiation device because of the life span and with keeping good sanitation.

[0041] In a preferred mode according to the technology described herein, the control device is configured to stop driving the ice making machine if the life span of the ultraviolet light irradiation device is not recovered when a predetermined time passes after informing that the ultraviolet light irradiation device is close to the end of the life span. According to such a configuration, a user is surely informed of the necessity of the replacement of the ultraviolet light irradiation device. Furthermore, the ice making machine is less likely to be operated by a user with an environment in which good sanitation cannot be ensured.

[0042] In a preferred mode according to the technology described herein, the water supply and discharge mechanism

includes water tank, an ice making water supply cavity, a returning cavity, and a liquid transfer pump. The water tank stores water to be supplied to the ice making section. The ice making water supply cavity connects the water tank and the ice making section and supplies the water in the water tank to the ice making section. The returning cavity is different from the ice making water supply cavity and connects the water tank and the ice making section and is for returning the water in the ice making section to the water tank. The liquid transfer pump is disposed on the returning cavity and transfers the water in the returning cavity to the water tank. In the water supply and discharge mechanism, the water tank, the ice making water supply cavity, and the returning cavity are configured as a circulation cavity and the ultraviolet light irradiation device is disposed on the circulation cavity. The control device is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the liquid transfer pump is driven, and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the liquid transfer pump is not driven. According to the above configuration, when the water stays in the irradiation area of an ultraviolet light irradiation device 3350 that is disposed on the circulation cavity, the amount of ultraviolet light to be irradiated is relatively decreased such that the ultraviolet light irradiation device has a longest life span. When a large amount of water passes through the irradiation area, a sufficient amount of ultraviolet light is irradiated and the UV sterilization can be effectively performed to circulating water.

[0043] In a preferred mode according to the technology described herein, the water supply and discharge mechanism includes a water tank that stores water to be supplied to the ice making section. The water tank includes a water amount sensor and the ultraviolet light irradiation device in an upper surface section. The water amount sensor detects a water level of the water stored in the water tank. The ultraviolet light irradiation device irradiates ultraviolet light to the water stored in the water tank. The control device is configured to decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the water level of the water stored in the water tank that is detected by the water amount sensor is relatively high, and increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the water level of the water stored in the water tank that is detected by the water amount sensor is relatively low. The irradiation intensity of ultraviolet light per a unit area is inversely proportional to the second power of a distance from the ultraviolet light source and therefore, the UV sterilization effects are exponentially decreased as the distance between the ultraviolet light irradiation device and a target object of the UV sterilization increases. According to the above configuration, the UV irradiation amount can be varied according to the distance between the ultraviolet light irradiation device that is disposed in the water tank and the water (a water

surface) stored in the water tank. Therefore, the water stored in the water tank can be preferably sterilized with ultraviolet light without being influenced by the distance between the ultraviolet light irradiation device and the water surface.

[0044] In a preferred mode according to the technology described herein, the ice storing section is disposed upper than the ice making section and includes an agitating member agitating ice transferred from the ice making section and a driving section driving the agitating member. The ultraviolet light irradiation device is disposed in the ice storing section. The control device is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the driving section drives the agitating member, and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the driving section does not drive the agitating member. According to such a configuration, the UV sterilization can be performed to the ice stored in the ice storing section. By increasing the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the agitating member is driven to agitate the ice, the ice can be sterilized with ultraviolet light effectively.

[0045] In a preferred mode according to the technology described herein, the ice making section includes an ice making unit forming the ice and a freezing unit cooling the ice making unit to an ice making temperature. The ice storing section and the ice making unit are communicated with each other via an ice cavity via which ice formed by the ice making unit is transferred. The ultraviolet light irradiation device is disposed on the ice cavity. The control device is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the freezing unit is driven, and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the freezing unit is not driven. According to such a configuration, the UV sterilization can be performed to the ice that is being transferred to the ice storing section after the ice is made. By increasing the amount of ultraviolet light irradiated by the ultraviolet light irradiation device while the ice making operation being performed and the ice being transferred in the ice transfer cavity, the ice can be sterilized with ultraviolet light effectively.

[0046] In a preferred mode according to the technology described herein, the ultraviolet light irradiation device is electrically connected to a visible light irradiation device in series and configured as an error detection circuit, and the visible light irradiation device is disposed at a position so as to be seen without taking apart the ice making machine. According to such a configuration, while ultraviolet light is emitted by the ultraviolet light irradiation device, visible light is emitted by the visible light irradiation device at the same time. If disconnection occurs in the ultraviolet light irradiation device, visible light is not emitted by the visible light irradiation device. If short-circuit occurs in the ultraviolet light irradiation device, light emission intensity

of visible light emitted by the visible light irradiation device becomes extremely high. Accordingly, with a simple configuration, the lighting state of ultraviolet light that is invisible to human can be checked with visible light.

[0047] In a preferred mode according to the technology described herein, the ultraviolet light irradiation device is electrically connected in series to a coil that is a portion of an a contact relay and a first resistor that has a relatively low resistance value so as to be configured as a first circuit. A contact point that is another portion of the a contact relay and becomes electrically conductive when a current flows to the coil, a second resistor that has a relatively high resistance value, and a visible light irradiation device are electrically connected in series and are configured as a second circuit. The first circuit and the second circuit are disposed in parallel and configured as an error detection circuit. According to such a configuration, while a current normally supplied to the ultraviolet light irradiation device and the ultraviolet light irradiation device emits ultraviolet light, visible light is also emitted by the visible light irradiation device at the same time. Accordingly, the lighting state of the ultraviolet light irradiation device that cannot be visibly checked by human can be checked more surely by checking the lighting state of visible light.

[0048] In a preferred mode according to the technology described herein, the ultraviolet light irradiation device is electrically connected in series to a coil that is a portion of a b contact relay so as to be configured as a first circuit. An alarm and a contact point that is another portion of the b contact relay and becomes open when a current flows to the coil are electrically connected in series and are configured as a second circuit. The first circuit and the second circuit are disposed in parallel and configured as an error detection circuit. According to such a configuration, when a current normally flows to the ultraviolet light irradiation device and the ultraviolet light irradiation device emits ultraviolet light, the alarm is not supplied with current and not operated. If no current flows to the ultraviolet light irradiation device, the alarm is supplied with current and is operated. With the alarm being a buzzer, abnormalities of the ultraviolet light irradiation device is informed with buzzer sound. Accordingly, with the ice making machine being installed at a position not to be visibly seen, a user can be informed of abnormalities of the ultraviolet light irradiation device.

[0049] In a preferred mode according to the technology described herein, the ice making machine further includes a temperature sensor measuring a temperature of the ultraviolet light irradiation device. The control device is configured to inform that the ultraviolet light irradiation device does not operate normally if a difference between an initial temperature when a current is started to be supplied to the ultraviolet light irradiation device and a temperature when a predetermined time passes after supplying of the current to the ultraviolet light irradiation device is smaller than a predetermined temperature difference. If the ultraviolet light irradiating device is

normally supplied with current and emits light for a predetermined time, the ultraviolet light irradiation device is heated to some extent. According to the above configuration, it can be determined that the ultraviolet light irradiation device does not operate normally with a simple configuration and utilizing the characteristics of the ultraviolet light irradiation device and a user is informed of such an abnormal state.

[0050] To solve the above problem, an ice making machine (may be referred to as a dispenser or an ice dispenser) according to the present disclosure includes:

<1> a housing; a storing section disposed in the housing and storing drink or food and including a discharge hole; a shutter closing and opening the discharge hole; shutter detection means detecting an open state and a closed state of the shutter, an ultraviolet light irradiation device irradiating ultraviolet light to the drink or food discharged through the discharge hole for sterilization; and a control section configured to control irradiation of ultraviolet light from the ultraviolet light irradiation device according to the open state and the closed state of the shutter that is detected by the shutter detection means.

[0051] According to the configuration of <1>, since the ultraviolet light irradiation intensity can be controlled according to the open state and the closed state of the shutter, ultraviolet light having high intensity can be irradiated only while the drink or food is being discharged. Therefore, the drink or food itself can be sterilized without excessively increasing consumption energy. As a result, the drink or food having high safety can be supplied. By shortening the time while the ultraviolet light having high intensity is irradiated, the ultraviolet light is less likely to leak outside the dispenser. Therefore, the ultraviolet light is less likely to hit a user's hand and health damage is less likely to be caused.

[0052] In the configuration of <1>, the drink or food may be liquid, solid, or mixture of solid and liquid. The irradiation intensity of ultraviolet light may be preferably set based on velocity of the drink or food that is an irradiation target.

[0053] <2> The control section may be configured to increase an irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if determining that the discharged hole is uncovered by the shutter, and decrease the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if determining that the discharged hole is closed by the shutter after increasing the irradiation intensity.

[0054] Specifically, sterilization of the drink or food to be supplied can be effectively performed with the control of <2>. In the configuration of <2>, the control section may determine that the shutter covers or uncovers the discharge hole based on signals from the shutter detection means. A time counter means counting time such as a timer may be further included and it may be determined that the shutter closes the discharge hole if a predetermined time passes after the increase of the ultraviolet light irradiation intensity. In the configuration of <2>, the

control section may be configured to control the ultraviolet light irradiation device to irradiate ultraviolet light at a constant irradiation intensity higher than $0 \mu\text{W}/\text{cm}^2$ before increasing the irradiation intensity and after decreasing the irradiation intensity. Accordingly, not only the drink or food itself can be sterilized when the drink or food being discharged but also the discharge cavity of the drink or food can be sterilized and maintained clean in the standby state. As a result, the drink or food having high safety can be preferably supplied.

[0055] <3> The housing may include an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing. A stage may be disposed below the outlet hole and a container for receiving the drink or food is disposed on the stage. An outlet hole cover that is movable to cover and uncover a space between the outlet hole and the stage may be mounted on the housing. The ice making machine may further include cover detection means detecting an open state and a closed state of the outlet hole cover. The control section may be configured not to increase the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if the cover detection means does not detect that the outlet hole cover is closed.

[0056] According to the configuration of <3>, when the outlet hole cover is not closed, ultraviolet light is not irradiated at a high intensity. Therefore, the ultraviolet light having high intensity is less likely to hit a user's hand and health damage is less likely to be caused. Particularly in a configuration that ultraviolet light is irradiated to outside of the outlet hole or in a configuration that ultraviolet light is emitted by an ultraviolet light irradiation device that is disposed outside the housing, the user's safety is increased. In the configuration of <3>, the control section may stop the ultraviolet light irradiation by the ultraviolet light irradiation device if not detecting that the outlet hole cover is closed. This further increases users' safety. In the configuration of <3>, the control section may increase the irradiation intensity if a predetermined time passes after detecting that the outlet hole cover is closed.

[0057] <4> The ultraviolet light irradiation device may be able to emit ultraviolet light and visible light, and the outlet hole cover may include a visible light transmission portion that blocks ultraviolet light and transmits visible light.

[0058] According to the configuration of <4>, the ultraviolet light irradiation device emits visible light and ultraviolet light and the emission of the ultraviolet light and the visible light can be visually checked through the outlet hole cover. Therefore, a trouble in the ultraviolet light irradiation device can be noticed early. When a user opens the outlet hole cover and takes out the container, the user can check that ultraviolet light is not emitted or the user can be careful so as not to hit the ultraviolet light if the ultraviolet light is emitted. As a result, safety for users can be further improved.

[0059] <5> A drainer that transmits ultraviolet light may

be disposed on a bottom surface portion of the storing section. The ultraviolet light irradiation device may be disposed on a lower surface side of the drainer to emit ultraviolet light upward.

[0060] According to the configuration of <5>, ultraviolet light can be irradiated to the drink or food that moves to be supplied toward the discharge hole. Particularly, with the ultraviolet light irradiation device being disposed on a bottom surface adjacent to the discharge hole, the drink or food that is to be discharged next can be sterilized intensively. The ultraviolet light irradiation device is disposed in the storing section and ultraviolet light is irradiated toward the inside of the storing section. Therefore, ultraviolet light is less likely to leak outside the housing. In the configuration of <5>, with the ultraviolet light irradiation device being disposed such that ultraviolet light can be irradiated to an upper section of the storing section and the discharge hole, when the shutter is closed, the surface of the shutter opposite the storing section is irradiated with ultraviolet light and when the shutter is open, a portion near the discharge hole is also irradiated with ultraviolet light. Thus, the portions irradiated with ultraviolet light can be sterilized.

[0061] <6> The shutter may be mounted to cover the discharge hole from a front side, and the ultraviolet light irradiation device may be disposed at a position in the housing so as to be opposite the shutter from a front side and to irradiate ultraviolet light rearward.

[0062] The shutter separates the storing section that is normally closed and the discharge cavity that is communicated to the outside. With the shutter being made of metal that has good durability against the repetitive opening and closing, thermal insulation properties are less likely to be maintained and condensation is likely to be caused on the front surface of the shutter. Splashes of discharged drink or food may adhere to an outer surface of the shutter that is exposed to outer air. Furthermore, the shutter has a complicated shape to exert a good closing and opening function. This makes it difficult to clean the shutter. As a result, bacteria are likely to grow on the outer surface of the shutter. According to the configuration of <6>, ultraviolet light can be intensively irradiated to the outer surface of the shutter to perform sterilization surely. In the configuration of <6>, the ultraviolet light irradiation device is preferably disposed at a position close to the shutter as much as possible.

[0063] <7> The housing may include an outlet hole that is communicated with the discharge hole and is below the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing. The ultraviolet light irradiation device may be disposed at a position in the housing so as to be in front of the discharge hole and above the outlet hole and to irradiate ultraviolet light rearward and downward.

[0064] According to the configuration of <7>, ultraviolet light can be irradiated to both the discharge hole, which is positioned behind the ultraviolet light irradiation device, and the outlet hole, which is positioned below the ultra-

violet light irradiation device. When the shutter is open, ultraviolet light can be irradiated to an edge section of the bottom of the storing section through the discharge hole. Therefore, drink or food can be provided with higher safety by sterilizing the drink or food that passes through the holes with keeping portions adjacent to the irradiated portions clean. With the configuration of <7> further including a stage on which a container that receives dispensed drink or food, ultraviolet light can be irradiated to the container that is disposed on the stage and the drink or food in the container. Furthermore, with an outer drain pan that receives drink or food that is not received by the container being disposed under the stage, ultraviolet light can be irradiated to the outer drain pan for sterilization.

[0065] <8> The housing may include on a front surface side an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container. The ultraviolet light irradiation device may be disposed on a bottom surface of the outer drain pan so as to emit ultraviolet light upward.

[0066] According to the configuration of <8>, with the ultraviolet light irradiation device being disposed far away from a target object, ultraviolet light can be irradiated by one ultraviolet light irradiation device not only to the outlet hole that is above the outer drain pan but also to the discharge cavity of the drink or food that is continuous upward from the outlet hole. When the container is set and the drink or food is dispensed, some of the drink or food that are dispensed may not be received by the container and may be received by the outer drain pan. The drink or food that is received by the outer drain pan is irradiated with ultraviolet light having high intensity to perform sterilization. This suppresses bacterial growth in the drain pan. In the configuration of <8>, the UV irradiation area is limited to a certain area and ultraviolet light emitting diodes having high directivity are preferably used for the ultraviolet light irradiation device.

[0067] <9> The housing may include on a front surface side an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container. The housing may include therein an inner drain pan that is disposed behind the outer drain pan and communicated with the outer drain pan. The ultraviolet light irradiation device may be disposed on a front side surface of the outer drain pan so as to emit ultraviolet light rearward.

[0068] If bacteria grow in the outer drain pan or in the inner drain pan, slimy substances may be created and a

water discharge outlet through which drain water is discharged outside the ice dispenser is clogged with the slimy substances. This may cause leaking of water or electric leakage. With the configuration of <9>, the outer drain pan, a connection portion (a cavity) that connects the outer drain pan and the inner drain pan can be irradiated with ultraviolet light. As a result, bacteria growth is less likely to be caused in the drain pan and the dispenser can be kept clean and troubles in water discharge can be reduced.

[0069] <10> The housing may include on a front surface side an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container. The housing may include therein an inner drain pan that is disposed in a lower section of the housing and a cavity that connects the outer drain pan and the inner drain pan. The ultraviolet light irradiation device may be disposed above the cavity so as to emit ultraviolet light downward.

[0070] According to the configuration of <10>, by irradiating ultraviolet light intensively to the cavity, drain water flowing from the outer drain pan to the inner drain pan can be surely sterilized.

Advantageous Effect of the Invention

[0071] According to the technology described herein, an ice making machine that can make sanitary ice with suppressing bacterial growth can be provided. An ice making machine that can keep an ice making machine and ice clean and have a longer life span with effectively using an ultraviolet light irradiation device can be provided. An ice making machine that can supply drink or food with high safety can be provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0072]

FIG. 1 is a perspective view of an ice making machine according to a first embodiment seen from a front upper side.

FIG. 2 is a block diagram schematically illustrating a configuration of the ice making machine.

FIG. 3 is a view schematically illustrating the configuration of the ice making machine (with a water tank and an ice making section illustrating cross-sectional configurations).

FIG. 4 is a magnified cross-sectional view illustrating surrounding sections of the water tank.

FIG. 5 is a perspective view of the water tank seen from a rear upper side with a cover being removed.

FIG. 6 is a perspective view of the water tank seen

from the rear upper side.

FIG. 7 is a cross-sectional view of the water tank seen from the rear lower side.

FIG. 8 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a first modification.

FIG. 9 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a second modification.

FIG. 10 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a third modification.

FIG. 11 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a second embodiment.

FIG. 12 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a fourth modification.

FIG. 13 is a magnified cross-sectional view of a portion of an ice making machine adjacent to a water tank according to a fifth modification.

FIG. 14 is a block diagram schematically illustrating a configuration of an ice making machine according to a third embodiment.

FIG. 15 is a view schematically illustrating the configuration of the ice making machine.

FIG. 16 is a magnified cross-sectional view of a portion near a cavity.

FIG. 17 is a view illustrating an ice making machine according to a fourth embodiment.

FIG. 18 is a cross-sectional view illustrating an ice making section and a cavity.

FIG. 19 is a view of an exit opening section seen from above (a cross sectional view along line VI-VI in FIG. 18).

FIG. 20 is a magnified cross-sectional view illustrating a portion of an ice making machine adjacent to a spout according to a sixth modification.

FIG. 21 is a magnified cross-sectional view illustrating a portion of an ice making machine adjacent to a spout according to a seventh modification.

FIG. 22 is a magnified cross-sectional view illustrating a spout and a portion of an ice making machine according to an eighth modification.

FIG. 23 is a view illustrating an ice making machine according to a fifth embodiment.

FIG. 24 is a view illustrating an ice making machine according to a ninth modification.

FIG. 25 is a perspective view illustrating an outer appearance of an ice making machine according to a sixth embodiment.

FIG. 26 is a cross-sectional view illustrating a general configuration of the ice making machine according to the sixth embodiment.

FIG. 27 is a block diagram of an ice making machine according to one embodiment.

FIG. 28 is a view illustrating a configuration of a circuit section of an ice making machine according to one

embodiment.

FIG. 29 is a view illustrating an example of target current values set in illustration environments of the ice making machine.

FIG. 30 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 31 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 32 is a cross-sectional view illustrating a configuration of an ice making machine according to a seventh embodiment.

FIG. 33 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 34 is a cross-sectional view illustrating a configuration of an ice making machine according to an eighth embodiment.

FIG. 35 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 36 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 37 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 38 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 39 is a cross-sectional view illustrating a configuration of an ice making machine according to a twelfth embodiment.

FIG. 40 is a flowchart illustrating one example of control of the ultraviolet light irradiation device.

FIG. 41 is a view illustrating one example of an error detection circuit of an ultraviolet light irradiation device.

FIG. 42 is a view illustrating one example of an error detection circuit of an ultraviolet light irradiation device.

FIG. 43 is a view illustrating one example of an error detection circuit of an ultraviolet light irradiation device.

FIG. 44 is a view illustrating one example of an error detection circuit of an ultraviolet light irradiation device.

FIG. 45 is a flowchart illustrating on example of error detection of the ultraviolet light irradiation device.

FIG. 46 is a perspective view illustrating an outer appearance of a dispenser according to a seventeenth embodiment.

FIG. 47 is a vertical cross-sectional view of the dispenser.

FIG. 48 is a magnified view illustrating a portion of FIG. 47 including a discharge hole and an outlet hole.

FIG. 49 is a block diagram generally illustrating a configuration related to control of an irradiation intensity of ultraviolet light.

FIG. 50 is a flowchart illustrating one example of control of an irradiation intensity.

FIG. 51 is a perspective view illustrating a portion of a dispenser according to an eighteenth embodiment.

FIG. 52 is a block diagram illustrating a general con-

figuration related to control of an irradiation intensity of ultraviolet light.

FIG. 53 is a flowchart of one example of control of the irradiation intensity.

FIG. 54 is a vertical cross-sectional view illustrating a portion of a dispenser according to a nineteenth embodiment.

FIG. 55 is a vertical cross-sectional view illustrating a portion of a dispenser according to a twentieth embodiment.

FIG. 56 is a vertical cross-sectional view illustrating a portion of a dispenser according to a twenty-first embodiment.

FIG. 57 is a vertical cross-sectional view illustrating a portion of a dispenser according to a twenty-second embodiment.

FIG. 58 is a vertical cross-sectional view illustrating a portion of a dispenser according to a twenty-third embodiment.

FIG. 59 is a vertical cross-sectional view illustrating a portion of a dispenser according to a twenty-fourth embodiment.

MODES FOR CARRYING OUT THE INVENTION

<First Embodiment>

[0073] A first embodiment according to the technology described herein will be described with reference to FIGS. 1 to 7. In this embodiment section, an auger type ice making machine 10 will be described. Arrow directions L, R, F, B, U, and D illustrated in each of the drawings represent a left side, a right side, a front side, a rear side, an upper side, and a lower side, respectively. As illustrated in FIG. 1, the ice making machine 10 includes a front wall 11 that is configured as a front side wall, side walls 12 that are configured as left and right walls, and an upper wall 13 that is configured as an upper side wall. The ice making machine 10 has a box shape as a whole. The front wall 11 includes an ice discharge portion 14 through which produced ice falls and is discharged outside.

[0074] As illustrated in FIGS. 2 and 3, the ice making machine 10 includes an ice making section 20, a freezing circuit 40, a water tank 60 (a tank), an ice tank 70, and a control section 80. The ice making section 20 includes a water storing section S that stores ice making water (water) supplied from the water tank 60. The ice making water stored in the water storing section S is frozen by the freezing circuit 40 and ice is made. The produced ice is transferred to the ice tank 70 and discharged from the ice discharge portion 14 (refer to FIG. 1). The water storing section S of the ice making section 20 receives the ice making water that is supplied from an outlet section 61A of the water tank 60 via a supply cavity 30 that connects the water storing section S and the water tank 60. A recovery cavity 31 that connects the water storing section S and the water tank 60 is provided separately from

the supply cavity 30. The ice making water that is not iced and stays in the water storing section S flows back to the water tank 60 via the recovery cavity 31. The recovery cavity 31 is a cavity different from the supply cavity 30. The recovery cavity 31 is provided with a pump device 32 (a pump) and the ice making water in the water storing section S is transferred to the water tank 60 again by driving of the pump device 32. The supply cavity 30, the recovery cavity 31, and the pump device 32 are referred to as a circulation mechanism 33. The control section 80 includes a computer, which includes a CPU, a RAM, and a ROM, as a main component and controls driving of the ice making section 20, the freezing circuit 40, and the pump device 32.

[0075] The ice making section 20 includes an ice making mechanism 20A, a driving section 20B, and a connection section 20C. The ice making mechanism 20A is a main section that makes ice. The driving section 20B drives the ice making mechanism 20A. The connection section 20C mechanically connects the ice making mechanism 20A and the driving section 20B and transfers driving power from the driving section 20B to the ice making mechanism 20A. As illustrated in FIG. 3, the ice making mechanism 20A includes a cylinder 21 (an ice making tube, a cooling tube), an auger 22, a forming member 23 (a fixed blade, a compression head), and a thermal insulation member 24. The cylinder 21 is made of metal (such as stainless steel) and has a tubular shape. An evaporation pipe 44 is fitted around an outer peripheral surface of the cylinder 21. The evaporation pipe 44 is configured as the freezing circuit 40. The cylinder 21 includes a water inlet port 21A and a water outlet port 21B in a side wall lower than the evaporation pipe 44. The ice making water supplied via the supply cavity 30 is supplied to the cylinder 21 through the water inlet port 21A. The ice making water in the cylinder 21 is discharged outside the cylinder 21 through the water outlet port 21B. The thermal insulation member 24 covers the outer surface of the evaporation pipe 44 and this increases a cooling effect.

[0076] The freezing circuit 40 includes a compressor 41, a condenser 42, an expansion valve 43, and the evaporation pipe 44 that are connected to each other with refrigerant pipes 45. The compressor 41 compresses refrigerant gas. The compressed refrigerant gas is cooled by a fan 46 and liquefied by the condenser 42. The refrigerant that is expanded by the expansion valve 43 is vaporized in the evaporation pipe 44 and the cylinder 21 is cooled. The freezing circuit 40 freezes the ice making water and produces ice on an inner peripheral surface of the cylinder 21. The freezing circuit 40 further includes a dryer 47 and temperature sensors 48. The dryer 47 removes moisture from the freezing circuit 40. One temperature sensor 48 is disposed adjacent to an outlet of the evaporation pipe 44 and another temperature sensor 48 is disposed between the condenser 42 and the dryer 47. The temperature sensors 48 detect temperature of the refrigerant.

[0077] The auger 22 included in the ice making mechanism 20A has a bar shape extending in an upper-bottom direction and is inserted in an inner space of the cylinder 21. The auger 22 includes a spiral scraping blade 22A on an outer peripheral surface. The scraping blade 22A protrudes from a bar-shaped body of the auger 22 toward an inner surface 21F of the cylinder 21. The scraping blade 22A has a protrusion dimension so as not to reach the inner surface 21F of the cylinder 21. The scraping blade 22A is rotated to scrape off the ice on the inner surface 21F of the cylinder 21.

[0078] The forming member 23 is inside the cylinder 21 and fixed to an upper portion of the cylinder 21. The forming member 23 has a tubular shape. The forming member 23 holds an upper portion 22B of the auger 22 therein such that the auger 22 is rotatable. The forming member 23 is a gear-shaped member that includes grooves, which extend along an axial direction, on an outer peripheral surface. The cylinder 21 includes an ice transfer cavity 23A that extends vertically between the forming member 23 and the inner surface 21F of the cylinder 21. The ice scraped off by the scraping blade 22A is transferred by rotation of the auger 22 and pushed into the ice transfer cavity 23A. The ice is compressed to be in a columnar shape and transferred to the ice tank 70.

[0079] As illustrated in FIGS. 4 and 5, the water tank 60 includes a storing section 61, a discharge section 62, and a cover 63. The storing section 61 stores ice making water therein. The ice making water that overflows from the storing section 61 is discharged outside via the discharge section 62. The storing section 61 and the discharge section 62 are covered with the cover 63 from an upper side. The storing section 61 has an elongated rectangular box shape that is elongated in a front-rear direction. The storing section 61 is open upward. The storing section 61 includes a recovery hole 64 and a protruded portion 65 on a front wall 61F. The recovery cavity 31 is connected to the recovery hole 64. The protruded portion 65 protrude inwardly.

[0080] As illustrated in FIGS. 4 and 7, the protruded portion 65 includes a top portion 65U that is tapered as it extends upward. The cover 63 includes an introduction section 68 right above the top portion 65U. Ice making water flows into the storing section 61 via the introduction section 68. The top portion 65U is disposed to be opposite an introduction opening 68A of the introduction section 68 (face the introduction opening 68A). The recovery hole 64 is on a left side of the top portion 65U. As illustrated in FIGS. 4 and 5, the storing section 61 includes an outlet section 61A in a middle of a lower wall 61D (a bottom portion configured as a bottom surface). The ice making water stored in the storing section 61 flows out through the outlet section 61A. The lower wall 61D is sloped downward as it extends toward the middle (toward the outlet section 61A). The outlet section 61A is connected to the supply cavity 30.

[0081] The discharge section 62 is disposed on a right wall 61R of the storing section 61. The discharge section

62 has a tubular shape extending in the upper-bottom direction. The discharge section 62 has a V shape seen from above such that a length measured in the front-rear direction becomes smaller as portions of the discharge section 62 are closer to the middle of the storing section 61. The discharge section 62 is configured so as not to block ultraviolet light irradiated by a UV sterilization device 90, which will be described later, to the inside of the storing section 61 (not to create a shadow). The discharge section 62 includes an upper opening 62U in an upper portion and opens upward. The ice making water stored in the storing section 61 overflows via the upper opening 62U. The upper opening 62U is disposed at a same level as (or a higher level than) the top portion 65U of the protruded portion 65 with respect to the upper-bottom direction. A lower opening 62D is inside the discharge section 62 and in a lower portion of the discharge section 62. The lower opening 62D is configured as an opening that is connected to a discharge cavity 66. Extra ice making water is discharged outside from the storing section 61 via the discharge cavity 66. As illustrated in FIG. 3, the discharge cavity 66 includes a trap 66T in a portion thereof. The trap 66T is formed in a S shape and temporally stores discharged water.

[0082] As illustrated in FIG. 4, a float switch 67 and the UV sterilization device 90 are disposed on the cover 63. The float switch 67 detects a water level of the ice making water stored in the storing section 61. The UV sterilization device 90 is disposed right above the protruded portion 65. The UV sterilization device 90 is disposed between the float switch 67 and the introduction section 68 via which tap water or ice making water enters. The UV sterilization device 90 is disposed in a middle of the cover 63 with respect to a right-left direction (in a paper thickness direction in FIG. 4). The UV sterilization device 90 irradiates ultraviolet light to ice making water and sterilize the ice making water. The introduction section 68 includes the introduction opening 68A, which opens toward the inside of the storing section 61, a water supply valve 68C, and a flow cavity 68B. The water supply valve 68C is connected to a supply tube 53 via which tap water flows from a water pipe. The water flows from the water supply valve 68C to the introduction opening 68A via the flow cavity 68B.

[0083] As illustrated in FIG. 6, the flow cavity 68B is bent in a S-shape in a portion close to the introduction opening 68A. Specifically, the flow cavity 68B includes a first bent portion 68B1, a second bent portion 68B2, a third bent portion 68B3, and a fourth bent portion 68B4. The first bent portion 68B1 is a portion that is bent leftward from an end of a portion extending directly downward from the water supply valve 68C. The second bent portion 68B2 is a portion that is bent downward from an end of a portion extending leftward from the first bent portion 68B1. The third bent portion 68B3 is a portion that is bent rightward from an end of a portion extending downward from the second bent portion 68B2. The fourth bent portion 68B4 is a portion that is bent downward from an end

of a portion extending rightward from the third bent portion 68B3. The fourth bent portion 68B4 is disposed on a right side with respect to the first bent portion 68B1. The introduction opening 68A is disposed directly below the fourth bent portion 68B4. Tap water supplied from the water supply valve 68C as the ice making water flows through the flow cavity 68B with winding and is supplied toward the top portion 65U of the protruded portion 65 through the introduction opening 68A. Then, the ice making water quietly flows down along a wall surface of the protruded portion 65 and is stored in the storing section 61.

[0084] As illustrated in FIGS. 6 and 7, the cover 63 includes a rear portion 63A, a rising portion 63B, and a front portion 63C. The float switch 67 is mounted on the rear portion 63A. The rising portion 63B protrudes upward than the rear portion 63A and is disposed in front of the rear portion 63A. The front portion 63C is disposed in front of the rising portion 63B and upper than the rear portion 63A. The UV sterilization device 90 and the introduction section 68 are mounted on the front portion 63C. The UV sterilization device 90 is disposed on a rear section of the front portion 63C (near an edge including the rising portion 63B). As illustrated in FIG. 7, the UV sterilization device 90 is arranged such that an irradiation portion 91 irradiating ultraviolet light faces the inside of the storing section 61 and an ultraviolet light irradiation range at least covers a flowing path of the ice making water flowing from the introduction section 68 to the inside of the storing section 61. The irradiation portion 91 has a circular shape seen from below. The ultraviolet light is irradiated from the irradiation portion 91 toward components disposed inside the storing section 61 such as the bottom portion 61D, the front wall 61F, the discharge section 62, and the protruded portion 65. The UV sterilization device 90 irradiates ultraviolet light toward the ice making water that is supplied from the introduction opening 68A toward the top portion 65U of the protruded portion 65 and flows down along the wall surface of the protruded portion 65 and the ice making water stored in the storing section 61. A UV sterilization device that irradiates ultraviolet light having a wavelength ranging from 253 nm to 285 nm can be used for the UV sterilization device 90. A protruding portion 92 is between the irradiation portion 91 and the introduction opening 68A. The protruding portion 92 protrudes downward from the front portion 63C and extends along a circumference of the irradiation portion 91. The protruding portion 92 has a semicircular shape having a center angle of about 180 degrees seen from below. As illustrated in FIG. 4, a protrusion dimension with which the protruding portion 92 protrudes downward from the front portion 63C (a vertical dimension of the protruding portion 92) is smaller than a height dimension of the rising portion 63B (a vertical dimension). The protrusion dimension of the protruding portion 92 is set such that the protruding portion 92 does not protrude downward further from the rear portion 63A. The protruding portion 92 prevents water supplied from

the introduction opening 68A from splashing at the top portion 65U of the protruded portion 65 and adhering to the irradiation portion 91. As illustrated in FIG. 3, the water tank 60 further includes a UV sterilization device 93 (a trap-side UV sterilization device) in addition to the UV sterilization device 90. The UV sterilization device 93 irradiates ultraviolet light to the inside of the trap 66T of the discharge cavity 66. This prevents bacterial growth inside the trap 66T.

[0085] The control section 80 (refer to FIG. 2) is configured to control driving of the pump device 32 according to the ultraviolet light irradiation by the UV sterilization device 90. Specifically, the control section 80 does not drive the pump device 32 until the ultraviolet light irradiation amount of the UV sterilization device 90 reaches 10 to 30 mJ/cm² and then drives the pump device 32 until about a half of the ice making water stored in the storing section 61 is replaced with newly supplied ice making water. The control section 80 controls the pump device 32 to repeat this operation. Accordingly, the ice making water circulated by the circulation mechanism 33 is effectively sterilized and the pump device 32 can be effectively driven to increase the life span of the pump device 32. The control section 80 may control the pump device 32 to become OFF while the UV sterilization device 90 irradiating ultraviolet light and control the pump device 32 to become ON while the UV sterilization device 90 not irradiating ultraviolet light. The control section 80 may control the UV sterilization device 90 and the pump device 32 to perform the above operations alternately in a repeated manner. In addition to the above operations, the control section 80 may sum up irradiation time that the UV sterilization device 90 has irradiated ultraviolet light. The control section 80 may increase the non-activation time of the pump device 32 as the summed-up irradiation time becomes longer.

[0086] Next, effects of this embodiment will be described. In this embodiment, the ice making machine 10 includes the water tank 60, the ice making section 20, and the UV sterilization device 90. The water tank 60 includes the introduction section 68 via which water enters the water tank 60 and the outlet section 61A through which the water exits the water tank 60. The water tank 60 stores water therein. The ice making section 20 freezes the water that flows through the outlet section 61A to make ice. The UV sterilization device 90 irradiates ultraviolet light to the ice and sterilizes the ice. The UV sterilization device 90 is disposed such that an ultraviolet light irradiation range at least covers a flowing path of the water flowing from the introduction section 68.

[0087] According to such an ice making machine 10, water flowing from the introduction section 68 and stored in the water tank 60 is sterilized with the ultraviolet light irradiated by the UV sterilization device 90 on the flowing path from the introduction section 68. Therefore, water stored in the water tank 60 can be effectively sterilized and kept clean inside the water tank 60. The water sterilized and stored in the water tank 60 in a clean manner

can flow through the outlet section 61A of the water tank 60 to the ice making section 20. Therefore, sanitary ice can be produced in the ice making section 20.

[0088] The water tank 60 includes the storing section 61 storing water and the discharge section 62 discharging water that overflows from the storing section 61 to the outside. The discharge section 62 is configured so as not to block ultraviolet light that is irradiated by the UV sterilization device 90 to the storing section 61. According to such an ice making machine 10, the storing section 61 includes no portions (shadows of the discharge section 62 are not created) that the ultraviolet light is blocked by the discharge section 62. Therefore, bacterial growth is prevented in the storing section 61.

[0089] The water tank 60 includes the protruded portion 65 protruding inward. The protruded portion 65 is tapered toward the top portion 65U that is opposite the introduction section 68. According to such an ice making machine 10, water flowing from the introduction section 68 hits the top portion 65U and is stored in the water tank 60 quietly. Therefore, a ripple is less likely to be created on a surface of the water stored in the water tank 60 and the water flowing into the water tank 60 is less likely to splash and water droplets are less likely to stick to the UV sterilization device 90. Ultraviolet light is less likely to inappropriately hit the water and the sterilizing effects is less likely to be lowered.

[0090] The introduction section 68 includes the introduction opening 68A that opens toward the inside of the storing section 61 and the flow cavity 68B that is a flowing path of water flowing from the outside of the water tank 60 to the introduction opening 68A. The flow cavity 68B is bent in a portion close to the introduction opening 68A. According to such an ice making machine 10, with the water flowing with winding in the portion of the flow cavity 68B close to the introduction opening 68A, a flowing speed of water is decreased and the water is less likely to flow into the water tank 60 with great force. Therefore, a ripple is less likely to be created on a surface of the water stored in the water tank 60 and the water flowing into the water tank 60 is less likely to splash and water droplets are less likely to stick to the UV sterilization device 90. Ultraviolet light is less likely to inappropriately hit the water and the sterilizing effects are less likely to be lowered.

[0091] The ice making machine 10 further includes the circulation mechanism 33 and the control section 80. With the circulation mechanism 33, the water that flows from the outlet section 61A into the ice making section 20 through the supply cavity 30 is transferred to the water tank 60 again by the driving of the pump device 32 through the cavity 31 that is different from the supply cavity 30. According to such an ice making machine 10, the water circulating through the water tank 60 and the ice making section 20 can be effectively sterilized by the UV sterilization device 90. Further, the UV sterilization device 90 and the pump device 32 can be activated efficiently and the life span of the devices can be increased.

[0092] The water tank 60 includes the storing section 61 storing water and the discharge section 62 from which water overflowing from the storing section 61 is discharged. The discharge section 62 includes the trap 66T that temporally stores discharged water. The trap-side UV sterilization device 93 is disposed in the trap 66T. The trap-side UV sterilization device 93 irradiates ultraviolet light to water and sterilize the water. With the discharge section 62 including the trap 66T, bacteria may grow in the trap 66T and a muddy object may be stuck in the flowing path of water flowing in the trap 66T. However, with the above ice making machine 10, the bacterial growth in the discharge section 62 is prevented and clogging of the path in the trap 66T is preferably suppressed.

<First Modification>

[0093] Next, a first modification according to the technology described herein will be described with reference to FIG. 8. In this modification, the same symbols are used for the components same as those of the above embodiment and configurations, operations, and effects same as those of the above embodiment will not be described. A water tank 160 includes a discharge section 162. Ice making water overflowing from a storing section 161 is discharged outside via the discharge section 162. The discharge section 162 is disposed close to the right wall 61R of the storing section 161. The discharge section 162 has a tubular shape that is elongated in the upper-bottom direction and has a diameter (with respect to a horizontal direction) that increases as it extends downward. The discharge section 162 has a V shape seen from above such that a length measured in the front-rear direction becomes smaller as the discharge section 162 extend toward the inside of the storing section 161. With such a configuration, the discharge section 162 is configured so as not to block ultraviolet light that is irradiated by the UV sterilization device 90 to the inside of the storing section 161. A lower opening 162D is in a lower middle section of the discharge section 162. The lower opening 162D is continuous to the discharge cavity 66.

<Second Modification>

[0094] Next, a second modification according to the technology described herein will be described with reference to FIG. 9. In this modification, the same symbols are used for the components same as those of the above embodiment and modification. Configurations, operations, and effects same as those of the above embodiment and modification will not be described. A water tank 260 includes a storing section 261, the discharge section 62, and the cover 63 covering the storing section 261 and the discharge section 62 from the above. The storing section 261 includes the recovery hole 64, which is connected to the recovery cavity 31, in a front wall 261F. An introduction section 268 is disposed on an upper right side (a back side on a paper sheet) of the recovery hole

64. Ice making water flows into the storing section 261 via the introduction section 268. The introduction section 268 includes an introduction opening 268A, which opens toward the inside of the storing section 261, the water supply valve 68C, and the flow cavity 68B. The water supply valve 68C is connected to the supply tube 53 via which tap water is supplied from a water pipe. The water flows from the water supply valve 68C (from the outside the water tank 260) to the introduction opening 268A via the flow cavity 68B. The introduction section 268 is mounted on the cover 263 so as to be tilted rearward as a whole and such that the introduction opening 268A faces the front wall 261F of the storing section 261. Tap water supplied from the water supply valve 68C as ice making water flows along the flow cavity 68B with winding. The ice making water that flows out from the introduction opening 268A hits the front wall 261F of the storing section 261 obliquely. Namely, the ice making water flowing into the storing section 261 from the introduction opening 268A does not flow directly down from the introduction opening 268A but flows obliquely in a front lower direction from the introduction opening 268A. With the introduction section 268 being mounted on the cover 263 in a tilted manner, the ice making water supplied obliquely with respect to the front wall 261F flows quietly along the front wall 261F and is stored in the storing section 261. Accordingly, a ripple is less likely to be created on a surface of the water stored in the storing section 261 and the water flowing into the storing section 261 is less likely to splash and water droplets are less likely to stick to the UV sterilization device 90. Ultraviolet light is less likely to inappropriately hit the water and the sterilizing effects is less likely to be lowered.

<Third Modification>

[0095] Next, a third modification according to the technology described herein will be described with reference to FIG. 10. In this modification, the same symbols are used for the components same as those of the above embodiment and modifications. Configurations, operations, and effects same as those of the above embodiment and modifications will not be described. A water tank 360 includes a discharge section 362. Ice making water overflowing from a storing section 361 is discharged outside via the discharge section 362. The discharge section 362 is disposed outside a right wall 361R of the storing section 361. The discharge section 362 has a tubular shape that is elongated in the upper-bottom direction. The right wall 361R of the storing section 361 includes an opening 362U in an upper portion of the discharge section 362. The opening 362U is through in the right-left direction. The ice making water stored in the storing section 361 overflows from the storing section 361 to the discharge section 362 through the opening 362U. The opening 362U is at a same level in the upper-bottom direction as (or higher than) the top portion 65U of the protruded portion 65.

[0096] The UV sterilization device 90 and a visible light irradiation portion 394 (a visible light irradiation device) that emits visible light are mounted on the cover 63. The visible light irradiation portion 394 is configured to irradiate visible light to the inside of the storing section 361 by control of the control section 80 (refer to FIG. 2) while the UV sterilization device 90 irradiating ultraviolet light. The control section 80 may control the visible light irradiation portion 394 to emit blinking visible light. The storing section 361 includes a visual check portion 369 in a left wall 61L. The visual check portion 369 is made of material that can transmit visible light (transparent or semitransparent resin material). With the side wall 12 of the ice making machine 10 (refer to FIG. 1) including a hole in a portion outside the visual check portion 369, the visible light irradiated by the visible light irradiation portion 394 can be visually checked through the visual check portion 369. According to such an ice making machine, a user can easily check the operation of the UV sterilization device 90 from the outside without taking the water tank 360 into pieces. With using material that can transmit visible light and block ultraviolet light being used as the material of the visual check portion 369, a user is not exposed with ultraviolet light irradiated by the UV sterilization device. An ice making machine that can be used safely is provided.

<Second Embodiment>

[0097] Next, a second embodiment according to the technology described herein will be described with reference to FIG. 11. In this embodiment, the same symbols are used for the components same as those of the above embodiment and modifications. Configurations, operations, and effects same as those of the above embodiment and modifications will not be described. A water tank 460 includes an outlet section 461A and a UV sterilization device 490 in a middle of a lower wall 461D (the bottom portion configured as the bottom surface) of a storing section 461. Ice making water stored in the storing section 461 flows out from the outlet section 461A. The UV sterilization device 490 is disposed adjacent to (on a front side on a paper sheet) the outlet section 461A. The bottom portion 461D is sloped downward at it extends closer to the middle (closer to the outlet section 461A). With the storing section 461 storing ice making water, the UV sterilization device 490 is under the water. The UV sterilization device 490 irradiates ultraviolet light upward from the water in the storing section 461. The bottom portion 461D has a diameter (with respect to the horizontal direction) that increases as it extends upward. The angle at which the bottom portion 461D is sloped is smaller than a light distribution angle of the ultraviolet light from the UV sterilization device 490. According to such an ice making machine, the UV sterilization device 90 is likely to irradiate ultraviolet light toward a whole inner surface of the inner walls of the water tank 460 from the water adjacent to the outlet section 461A. Therefore,

the ice making water stored in the water tank 460 and the inner walls of the water tank 460 can be effectively kept clean.

5 <Fourth Modification>

[0098] Next, a fourth modification according to the technology described herein will be described with reference to FIG. 12. In this modification, the same symbols are used for the components same as those of the above embodiments and modifications. Configurations, operations, and effects same as those of the above embodiments and modifications will not be described. A water tank 560 includes a storing section 561 and a cover 563 that covers the storing section 561 and the discharge section 62 from the above. An introduction section 568 is in a lower section of a left wall 561L of the storing section 561. Ice making water flows into the storing section 561 via the introduction section 568. The introduction section 568 includes an introduction opening 568A, which opens toward the inside of the storing section 561, and a flow cavity 568B, which is connected to a supply pipe through which tap water is supplied from a water pipe. A UV sterilization device 590 is disposed on a bottom portion 561D, which is configured as a bottom surface of the storing section 561, and adjacent to the introduction section 568. With the storing section 561 storing ice making water, the UV sterilization device 590 is under the water. The UV sterilization device 590 irradiates ultraviolet light upward from the water inside the storing section 561. Tap water supplied from the water pipe as ice making water flows through the flow cavity 568B and is supplied to the right above the UV sterilization device 590 from the introduction opening 568A and stored in the storing section 561. The introduction section 568 may be mounted on the wall 561L such that ice making water flowing from the introduction opening 568A can be directly supplied to an upper surface of the UV sterilization device 590 (a surface through which ultraviolet light exits toward the inside of the storing section 561). Accordingly, impurities contained in the ice making water (tap water) sticking on the upper surface of the UV sterilization device 590 can be removed with a flow of ice making water that flows from the introduction opening 568A that is above the UV sterilization device 590. This suppresses lowering of the sterilizing effects of the UV sterilization device 590.

<Fifth Modification>

[0099] Next, a fifth modification according to the technology described herein will be described with reference to FIG. 13. In this modification, the same symbols are used for the components same as those of the above embodiments and modifications. Configurations, operations, and effects same as those of the above embodiments and modifications will not be described. A water tank 660 includes a storing section 661 and a cover 663 that covers the storing section 661 and the discharge

section 62 from the above. Three introduction sections 668D, 668E, 668F are disposed on the cover 663. Ice making water flows into the storing section 661 via the introduction sections 668D, 668E, 668F. The introduction sections 668D, 668E, 668F are arranged in a line in this order from the front side. Each of the introduction sections 668D, 668E, 668F includes an introduction opening 668A that opens toward the inside of the storing section 661 and a flow cavity 668B that is connected to a supply pipe through which tap water is supplied from a water pipe. Three UV sterilization devices 690D, 690E, 690F are disposed on a bottom portion 661D, which is configured as a bottom surface of the storing section 661. The UV sterilization devices 690D, 690E, 690F are arranged in a line in this order from the front side. With the storing section 661 storing ice making water, the UV sterilization devices 690D, 690E, 690F are under the water and irradiate ultraviolet light upward from the water inside the storing section 661. The introduction openings 668A of the introduction sections 668D, 668E, 668F are disposed directly above the UV sterilization devices 690D, 690E, 690F, respectively. Tap water supplied from the water pipe as ice making water flows through the flow cavities 668B of the introduction sections 668D, 668E, 668F and is supplied to the right above the UV sterilization devices 690D, 690E, 690F from the respective introduction openings 668A and stored in the storing section 661. Impurities contained in the ice making water (tap water) sticking on the upper surfaces of the UV sterilization devices 690D, 690E, 690F can be removed by a flow of ice making water that flows from the introduction sections 668D, 668E, 668F that are right above the UV sterilization devices 690D, 690E, 690F, respectively. This suppresses lowering of the sterilizing effects of the UV sterilization devices 690D, 690E, 690F.

<Third Embodiment>

[0100] Next, a third embodiment according to the technology described herein will be described with reference to FIGS. 14 to 16. In this embodiment section, an auger type ice making machine 2010 will be described. As illustrated in FIGS. 14 and 15, the ice making machine 2010 includes an ice making section 2020, a freezing circuit 2040, a water tank 2060, an ice tank 2070, and a control section 2080. The ice making section 2020 includes a water storing section 2000S that stores ice making water (water) supplied from the water tank 2060. The ice making water stored in the water storing section 2000S is frozen by the freezing circuit 2040 and ice is made. The produced ice is transferred to the ice tank 2070 via a transfer cavity 2050 to the ice tank 2070 and stored in the ice tank 2070. The water storing section 2000S of the ice making section 2020 receives ice making water that is supplied from an outlet section 2063 of the water tank 2060 and via a supply cavity 2030 that connects the water storing section 2000S and the water tank 2060. A recovery cavity 2031 that connects the water

storing section 200S and the water tank 2060 is provided separately from the supply cavity 2030. Some of the ice making water that is not iced in the water storing section 200S flows back to the water tank 2060 via the recovery cavity 2031. The recovery cavity 2031 is a cavity different from the supply cavity 2030. The recovery cavity 2031 is provided with a pump device 2032 and the ice making water in the water storing section 200S is transferred to the water tank 2060 by driving of the pump device 2032. The supply cavity 2030, the recovery cavity 2031, and the pump device 2032 are referred to as a circulation mechanism 2033. The control section 2080 includes a computer, which includes a CPU, a RAM, and a ROM, as a main component and controls driving of the ice making section 2020, the freezing circuit 2040, the pump device 2032, and a UV sterilization device 2073, which will be described later.

[0101] The water tank 2060 includes an introduction section 2061, a discharge section 2062, and an outlet section 2063. Tap water as ice making water flows into the water tank 2060 via the introduction section 2061. The ice making water stored in the water tank 2060 is discharged outside via the discharge section 2062. The outlet section 2063 is connected to the supply cavity 2030 and the ice making water stored in the water tank 2060 flows out via the outlet section 2063 to the ice making section 2020. The water tank 2060 further includes a water tank UV sterilization device 2064 and an ultrasonic sensor 2065. The water tank UV sterilization device 2064 irradiates ultraviolet light to the ice making water stored in the water tank 2060 and sterilize the ice making water. The ultrasonic sensor 2065 detects a water level of the ice making water stored in the water tank 2060. A first discharge pipe 2066 is connected to a lower portion of the discharge section 2062. A second discharge pipe 2067 is connected to a bottom wall 2070B, which is configured as a bottom surface of the ice tank 2070. Water from melted ice stored in the ice tank 2070 is discharged via the second discharge pipe 2067. The first discharge pipe 2066 and the second discharge pipe 2067 are joined inside the ice making machine 2010. Water in the discharge pipes passes through a check valve trap 2069 disposed on the joined pipe and is discharged outside. The check valve trap 2069 prevents discharged water and gas from returning to the water tank 2060 and the ice tank 2070 and strange smell or bacteria is less likely to be caused inside the ice making machine 2010.

[0102] The ice making section 2020 includes an ice making mechanism 2020A, a driving section 2020B, and a connection section 2020C. The ice making mechanism 2020A is a main section that makes ice. The driving section 2020B drives the ice making mechanism 2020A. The connection section 2020C mechanically connects the ice making mechanism 2020A and the driving section 2020B and transfers driving power from the driving section 2020B to the ice making mechanism 2020A. As illustrated in FIGS. 15 and 16, the ice making mechanism 2020A includes a cylinder 2021 (the ice making tube, the cooling

tube), an auger 2022, a forming member 2023 (the fixed blade, the compression head), and a thermal insulation member 2024. The cylinder 2021 is made of metal (such as stainless steel) and has a tubular shape. An evaporation pipe 2044 is fitted around an outer peripheral surface of the cylinder 2021. The evaporation pipe 2044 is configured as the freezing circuit 2040. The cylinder 2021 includes a water inlet port 2021A and a water outlet port 2021B in a lower side wall lower than the evaporation pipe 2044. The ice making water supplied via the supply cavity 2030 is supplied to the cylinder 2021 through the water inlet port 2021A. The ice making water in the cylinder 2021 is discharged outside the cylinder 2021 through the water outlet port 2021B. The thermal insulation member 2024 covers the outer surface of the evaporation pipe 2044 and this increases a cooling effect.

[0103] The freezing circuit 2040 includes a compressor 2041, a condenser 2042, an expansion valve 2043, and the evaporation pipe 2044 that are connected to each other with refrigerant pipes 2045. The compressor 2041 compresses refrigerant gas. The compressed refrigerant gas is cooled by a fan 2046 and liquefied by the condenser 2042. The refrigerant that is expanded by the expansion valve 2043 is vaporized in the evaporation pipe 2044 and the cylinder 2021 is cooled. The freezing circuit 2040 freezes the ice making water and produces ice on an inner peripheral surface of the cylinder 2021. The freezing circuit 2040 further includes a dryer 2047 and a temperature sensor 2048. The dryer 2047 removes moisture from the freezing circuit 2040. The temperature sensor 2048 is disposed between the condenser 2042 and the dryer 2047. The temperature sensor 2048 detects temperature of the refrigerant.

[0104] The auger 2022 included in the ice making mechanism 2020A has a bar shape extending in the upper-bottom direction and is inserted in an inner space of the cylinder 2021. The auger 2022 includes a spiral scraping blade 2022A on an outer peripheral surface. The scraping blade 2022A protrudes from a bar-shaped body of the auger 2022 toward an inner surface 2021F of the cylinder 2021. The scraping blade 2022A has a protrusion dimension so as not to reach the inner surface 2021F of the cylinder 2021. The scraping blade 2022A is rotated to scrape off the ice on the inner surface 2021F of the cylinder 2021.

[0105] The forming member 2023 is inside the cylinder 2021 and fixed to an upper portion of the cylinder 2021. The forming member 2023 has a tubular shape. An upper portion 2022B of the auger 2022 is inserted in the forming member 2023 such that the auger 2022 is rotatably held by the forming member 2023. The forming member 2023 includes dividing portions 2023A that radially extend toward an outer peripheral surface. The dividing portions 2023A have a plate shape extending in the upper-bottom direction. Spaces between adjacent dividing portions 2023A are ice transfer cavities that the ice passes through. The ice scraped by the scraping blade 2022A is transferred upward by the rotation of the auger 2022 and

divided by the dividing portions 2023A. Then, the ice is pushed into the ice transfer cavities that are spaces between the adjacent dividing portions 2023A and formed into a columnar shape with being compressed and transferred to the transfer cavity 2050.

[0106] As illustrated in FIG. 16, the transfer cavity 2050 is a tubular member that connects the ice making section 2020 and the ice tank 2070. The ice is transferred from the ice making section 2020 to the inside of the ice tank 2070 via the transfer cavity 2050. The transfer cavity 2050 includes a spout 2051 and a connection pipe 2052. The spout 2051 is connected to the upper portion of the ice making section 2020. The connection pipe 2052 is connected to a right end 2051R of the spout 2051 and a side wall 2070A of the ice tank 2070. The spout 2051 extends rightward in the horizontal direction (toward the ice tank 2070) from the upper portion of the ice making section 2020. The connection pipe 2052 has a diameter that is slightly greater than a diameter of the right end 2051R of the spout 2051. The right end 2051R of the spout 2051 is fitted in a left end 2052L of the connection pipe 2052. A right end 2052R of the connection pipe 2052 is inserted in an upper portion of the side wall 2070A of the ice tank 2070 (into an upper left portion of the ice tank 2070). The connection pipe 2052 has an opening 2052R1 at the right end 2052R. The opening 2052R1 opens toward the inside of the ice tank 2070.

[0107] In the ice making section 2020, a rotary member 2028 (a cutter) is disposed above the forming member 2023. The rotary member 2028 coaxially rotates with the auger 2022. A protrusion 2029 horizontally protrudes from the rotary member 2028. The ice making section 2020 is connected to the spout 2051 with the rotary member 2028 being disposed inside the spout 2051. An exit opening section 2027 is at upper portions of the dividing portions 2023A. Columnar ice pieces that pass through the spaces (ice transfer cavity) between the adjacent dividing portions 2023A exit to the spout 2051 through the exit opening section 2027 that includes an opening. The columnar ice pieces that exit to the spout 2051 through the exit opening section 2027 are cut into pieces having a predefined length by the protrusion 2029 of the rotating cutter 2028 and are transferred in the connection pipe 2052 and exit to the inside of the ice tank 2070 through the opening 2052R1.

[0108] As illustrated in FIGS. 15 and 16, the ice tank 2070 is disposed on a right side of the ice making section 2020. The ice tank 2070 includes side walls 2070A, a bottom wall 2070B that is a lower wall and configured as a bottom surface, and an upper wall 2070C. An inner surface portion of each of the walls 2070A, 2070B, 2070C is made of metal such as aluminum. Ultraviolet light is reflected inside the ice tank 2070. The bottom wall 2070B includes a bottom wall opening 2070B1 that is connected to the second discharge pipe 2067. An inner surface of the bottom wall 2070B is a sloped surface that is sloped downward as it extends toward the bottom wall opening 2070B1.

[0109] An ultrasonic sensor 2071 (an ice detection device) and a spray nozzle 2072 are mounted on the upper wall 2070C. The ultrasonic sensor 2071 detects a height of ice stored in the ice tank 2070 with ultrasonic wave. Cleaning liquid for removing bacteria or dirt is sprayed from the spray nozzle 2072 to the inside of the ice tank 2070. An inner surface of the upper wall is sloped upward (toward outside) as it extends closer to the spray nozzle 2072. The ultrasonic sensor 2071 is disposed between the spray nozzle 2072 and the opening 2052R1 of the connection pipe 2052. The spray nozzle 2072 is formed such that a lower portion 2072B has a semicircular cross-sectional shape. With the spray nozzle 2072 being rotated, the cleaning liquid is sprayed to the walls 2070A, 2070B, 2070C and clean the walls. The spray nozzle 2072 is disposed such that the lower portion 2072B is horizontally arranged with respect to the opening 2052R1 and a UV sterilization device 2073, which will be described later. The cleaning liquid is sprayed to the inside of the connection pipe 2052 and the spout 2051 through the opening 2052R1 and also to the UV sterilization device 2073. Thus, the inside of the connection pipe 2052 and the spout 2051 and the UV sterilization device 2073 can be cleaned. The cleaning liquid sprayed from the spray nozzle 2072 may be the ice making water supplied from the water tank 2060. A circular wall 2071C extends around the ultrasonic sensor 2071. The circular wall 2071C protrudes downward from the upper wall 2070C and has a circular shape seen from below and extending around the ultrasonic sensor 2071. The cleaning liquid sprayed from the spray nozzle 2072 can flow along the upper wall 2070C toward the side walls 2070A.

[0110] The UV sterilization device 2073 that irradiates ultraviolet light to and sterilize ice is mounted on the side wall 2070A. The UV sterilization device that irradiates ultraviolet light having a wavelength ranging from 253 nm to 285 nm can be used for the UV sterilization device 2073. The UV sterilization device 2073 is arranged such that an ultraviolet light irradiation range of the UV sterilization device 2073 includes at least a moving range of the ice that moves in the transfer cavity 2050. Specifically, the UV sterilization device 2073 is arranged opposite the opening 2052R1 and on a right side of the opening 2052R1 of the connection pipe 2052 and the rotary member 2028 of the ice making section 2020 with respect to the horizontal direction (so as to face the opening 2052R1). The UV sterilization device 2073 is on the right side of a center of a diameter (a middle with respect to the upper-bottom direction) of each of the spout 2051 and the connection pipe 2052 with respect to the horizontal direction. The UV sterilization device 2073 is on an extension line along a moving direction in which the ice moves inside the transfer cavity 2050. Positions of the rotary member 2028 of the ice making section 2020, the ultrasonic sensor 2071, the spray nozzle 2072, and the UV sterilization device 2073 with respect to the front-rear direction on the paper sheet are same. The UV sterilization device 2073 irradiates ultraviolet light toward the

inside of the transfer cavity 2050, the spray nozzle 2072, and the walls 2070A, 2070B, 2070C.

[0111] Next, effects of this embodiment will be described. In this embodiment, the ice making machine includes the ice making section 2020, the ice tank 2070, the transfer cavity 2050, and the UV sterilization device 2073. The ice making section 2020 freezes water and produce ice. The ice tank 2070 stores ice therein. The transfer cavity 2050 extends to connect the ice making section 2020 and the ice tank 2070. The transfer cavity 2050 is a path along which the ice moves from the ice making section 2020 to the inside of the ice tank 2070. The UV sterilization device 2073 irradiates ultraviolet light to sterilize the ice. The UV sterilization device 2073 is disposed such that the ultraviolet light irradiation range at least includes a movement range of the ice that moves in the transfer cavity 2050.

[0112] According to such an ice making machine, the ice made by the ice making section 2020 is sterilized with the ultraviolet light irradiated by the UV sterilization device 2073 on the way of moving from the ice making section 2020 to the inside of the ice tank 2070 via the transfer cavity 2050. Accordingly, clean ice can be stored in the ice tank 2070 and supplied to a user.

[0113] The transfer cavity 2050 includes the opening 2052R1 that opens toward the inside of the ice tank 2070. The UV sterilization device 2073 is disposed in the ice tank 2070 so as to face the opening 2052R1. With such an ice making machine, the ultraviolet light can be irradiated to the inside of the transfer cavity 2050 through the opening 2052R1 from the ice tank 2070 side. Therefore, the ice moving in the transfer cavity 2050 toward the ice tank 2070 can be effectively sterilized. In a configuration that a user takes out the ice from the ice tank 2070 with a scoop, bacterial infection is likely to be caused in the ice stored in the ice tank 2070, the inside of the ice tank 2070, and the transfer cavity 2050 that is continuous to the ice tank 2070. However, with the above-described ice making machine, the ice stored in the ice tank 2070, and the inside of the transfer cavity 2050 and the ice tank 2070 are sterilized and sanitary ice can be provided.

[0114] The inner surface portions of the ice tank 2070 are configured to reflect ultraviolet light. The UV sterilization device 2073 is disposed such that the ultraviolet light irradiation range includes the inner walls 2070A, 2070B, 2070C of the ice tank 2070. According to such an ice making machine, the ultraviolet light irradiated by the UV sterilization device 2073 reflects off the inner walls 2070A, 2070B, 2070C of the ice tank 2070 and reflected ultraviolet light reaches any inner portions of the ice tank 2070 such as a portion of the spray nozzle 2072 that is on an opposite side from the UV sterilization device 2073.

<Fourth Embodiment>

[0115] Next, a fourth embodiment according to the technology described herein will be described with ref-

erence to FIGS. 17 to 19. In this embodiment, the same symbols are used for the components same as those of the above embodiments and configurations, operations, and effects same as those of the above embodiments will not be described. As illustrated in FIG. 17, an ice making machine 2200 includes an upper section 2201 and a lower section 2202 and has a box shape elongated in the upper-bottom direction as a whole. The upper section 2201 includes an ice making section 2220 and a transfer cavity 2250. The lower section 2202 includes an ice tank 2270 and is disposed under the upper section 2201. The ice making section 2220 includes an ice making mechanism 2220A, a driving section 2220B, and a connection section 2220C. The ice making mechanism 2220A is a main section that makes ice. The driving section 2220B drives the ice making mechanism 2220A. The connection section 2220C mechanically connects the ice making mechanism 2220A and the driving section 2220B and transfers driving power from the driving section 2220B to the ice making mechanism 2220A. The ice tank 2270 is disposed under the ice making section 2220 and the transfer cavity 2250. The ice tank 2270 stores produced ice 2000I.

[0116] As illustrated in FIG. 18, the transfer cavity 2250 is a tubular member that connects the ice making section 2220 and the ice tank 2270. The ice is transferred from the ice making section 2220 to the inside of the ice tank 2270 via the transfer cavity 2250. The transfer cavity 2250 includes a spout 2251 and a chute 2252 (a connection pipe or an upper-bottom cavity). The chute 2252 extends in the upper-bottom direction on a right side of the ice making section 2220. An upper end 2252A of the chute 2252 is fitted to a right lower end 2251R of the spout 2251. The chute 2252 extends through an upper wall 2270A of the ice tank 2270 at a lower end 2252D thereof and the lower end 2252D opens toward the inside of the ice tank 2270.

[0117] The spout 2251 includes an upper wall 2251A and a side wall 2251B that is configured as a right side wall. The spout 2251 further includes a lower wall 2251C and a sloped wall 2251D. The lower wall 2251C is opposite the upper wall 2251A and is continuous to an exit opening section 2227 of the ice making section 2220. The sloped wall 2251D is on a right side of the lower wall 2251C and is a sloped surface that extends downward as it extends toward the side wall 2251B. A rotary member 2228 and a protrusion 2229 of the ice making section 2220 are disposed above the lower wall 2251C and inside the spout 2251. Columnar ice pieces that are transferred into the spout 2251 through an exit opening section 2227 of the ice making section 2220 are cut into pieces having a predefined length by the protrusion 2229 of the rotary member 2228 and are transferred along the sloped wall 2251D toward the chute 2252. The ice pieces fall down in the chute 2252 and exit to the inside of the ice tank 2270.

[0118] FIG. 19 is a view of the exit opening section 2227 seen from above and illustrates UV sterilization de-

vices 2273 with a cross-sectional view. An upper portion 2022B of the auger 2022 is inserted in a ring portion 2223B of a forming member 2223. The ring portion 2223B holds the auger 2022 to be rotatable. The forming member 2223 includes dividing portions 2223A that radially extend from the ring portion 2223B. The dividing portions 2223A (illustrated with dots) have a plate shape extending in the front-back direction on the paper sheet (the upper-bottom direction in FIG. 18). Spaces between adjacent dividing portions 2223A are ice transfer cavities 2000P that the ice passes through. The exit opening section 2227 is at upper portions of the dividing portions 2223A and the ice transfer cavities 2000P and has a circular shape seen from above. As illustrated in FIGS. 18 and 19, the ice scraped off by the scraping blade 2022A is transferred upward by the rotation of the auger 2022 and divided by the dividing portions 2223A. Then, the ice is pushed into the ice transfer cavities 2000P that are spaces between the adjacent dividing portions 2223A and compressed into a columnar shape and transferred to the spout 2251 through the exit opening section 2227.

[0119] The UV sterilization devices 2273 are mounted on an inner surface of the upper wall 2251A so as to be directly above the exit opening section 2227 of the ice making section 2220 (so as to face the exit opening section 2227). The UV sterilization devices 2273 irradiate ultraviolet light to sterilize the ice. The UV sterilization devices 2273 are arranged in a circular form as a whole seen from above. The UV sterilization devices 2273 are arranged so as to overlap the dividing portions 2223A and the ice transfer cavities 2000P. The UV sterilization devices 2273 are arranged directly above (to face) the dividing portions 2223A and the ice transfer cavities 2000P.

[0120] Next, effects of this embodiment will be described. In this embodiment, the ice making section 2220 includes the exit opening section 2227 that is an opening through which produced ice exits to the spout 2251. The UV sterilization devices 2273 are disposed in the spout 2251 so as to face the exit opening section 2227. According to such an ice making machine 2200, ultraviolet light irradiated by the UV sterilization devices 2273 travels to the inside of the ice making section 2220 through the exit opening section 2227 and the inside of the ice making section 2220 can be sterilized effectively.

[0121] The exit opening section 2227 includes the dividing portions 2223A for dividing the produced ice. The UV sterilization devices are disposed in the spout 2251 so as to face the dividing portions 2223A. With such an ice making machine 2200, ultraviolet light irradiated by the UV sterilization devices 2273 can travel through the ice transfer cavities 2000P between the dividing portions 2223A and reach the inside of the ice making section 2220. Thus, the inside of the ice making section 2220 can be sterilized effectively.

<Sixth Modification>

[0122] Next, a sixth modification according to the technology described herein will be described with reference to FIG. 20. In this modification, the same symbols are used for the components same as those of the above embodiments, and configurations, operations, and effects same as those of the above embodiments will not be described. An UV sterilization device 2373 is mounted on the upper wall 2251A of a spout 2351 of a transfer cavity 2350. The UV sterilization device 2373 irradiates ultraviolet light to sterilize ice. The UV sterilization device 2373 is directly above a portion between the lower wall 2251C and the sloped wall 2251D. A protruding portion 2374, which is a wall, protrudes downward from an inner wall surface of the upper wall 2251A of the spout 2351. The protruding portion 2374 is on a left side of the UV sterilization device 2373 and between the UV sterilization device 2373 and the exit opening section 2227. The ice that exits through the exit opening section 2227 is broken into pieces and small broken ice pieces and water are splashed when the ice moves in the spout 2351. The protruding portion 2374 protects the UV sterilization device 2373 from the splashed small ice pieces and water. Therefore, insufficient ultraviolet light irradiation and lowering of sterilizing effects are suppressed.

<Seventh Modification>

[0123] Next, a seventh modification according to the technology described herein will be described with reference to FIG. 21. In this modification, the same symbols are used for the components same as those of the above embodiments, and configurations, operations, and effects same as those of the above embodiments will not be described. An UV sterilization device 2473 that irradiates ultraviolet light to sterilize ice is mounted on the upper wall 2251A of a spout 2451. In an ice making section 2420, a rotary member 2428 (the cutter) is disposed above the forming member 2223. The rotary member 2428 coaxially rotates with the auger 2022. Produced ice is cut into pieces by rotation of the rotary member 2428. A reflection member 2429 is mounted on the rotary member 2428. The reflection member 2429 is made of metal such as aluminum and reflects ultraviolet light. The reflection member 2429 has an asymmetric shape with respect to the right-left direction. The reflection member 2429 rotates coaxially with the rotary member 2428. According to such an ice making machine, ultraviolet light irradiated by the UV sterilization device 2473 reflects off the reflection member 2429 that rotates with the rotary member and is dispersed and travels in multiple directions. Accordingly, the ultraviolet light can be supplied to a relatively large area including the exit opening section 2227 and the spout 2451. In this modification, the ice making machine includes the ice tank 2270 below the ice making section 2420 and a transfer cavity 2450 similar to the fourth embodiment; however, the configuration of

the ice making machine is not limited to this. For example, an ice making machine may include an ice tank above the ice making section and a rotary member may protrude into the ice tank. In such a configuration, the UV sterilization device may be disposed inside the ice tank as described in the third embodiment.

<Eighth Modification>

[0124] Next, an eighth modification according to the technology described herein will be described with reference to FIG. 22. In this modification, the same symbols are used for the components same as those of the above embodiments, and configurations, operations, and effects same as those of the above embodiments will not be described. In a transfer cavity 2550, a UV sterilization device 2573 that irradiates ultraviolet light to sterilize ice is mounted on an upper wall 2551A of a spout 2551. An ice making section 2520 includes a gas flow cavity 2522C that extends inside an auger in the upper-bottom direction. The gas flow cavity 2522C connects the inside of the spout 2551 of the transfer cavity 2550 and the inside of the cylinder 2021. Gas can flow inside the gas flow cavity 2522C. The gas flow cavity 2522C includes a cylinder-side opening 2522C1 at an end close to the cylinder 2021 and a spout-side opening 2522C2 (a gas flow opening) at an end close to the spout 2551. The spout-side opening 2522C2 is in a middle of the rotary member 2528 with respect to the horizontal direction and is included in an exit opening section 2527. The UV sterilization device 2573 is directly above (faces) the spout-side opening 2522C2. According to such an ice making machine, ultraviolet light irradiated by the UV sterilization device 2573 enters the gas flow cavity 2522C through the spout-side opening 2522C2. Thus, bacterial growth inside the gas flow cavity 2522C can be suppressed.

<Fifth Embodiment>

[0125] Next, a fifth embodiment according to the technology described herein will be described with reference to FIG. 23. In this embodiment, the same symbols are used for the components same as those of the above embodiments, and configurations, operations, and effects same as those of the above embodiments will not be described. An ice making machine 2600 includes an upper section 2601 and the lower section 2202. The upper section 2601 includes the ice making section 2220 and a transfer cavity 2650. The lower section 2202 is disposed under the upper section 2601. The transfer cavity 2650 includes a spout 2651 that is connected to an upper portion of the ice making section 2220 and a chute 2652 (an upper-bottom cavity) that is connected to the spout 2651. The chute 2652 extends in the upper-bottom direction on a right side of the ice making section 2220. An upper end of the chute 2252 is fitted to a right lower end 2651R of the spout 2651. The chute 2652 extends through the upper wall 2270A of the ice tank 2270 at a

lower end 6252D thereof and the lower end 2652D opens toward the inside of the ice tank 2270. Columnar ice pieces that exit to the spout 2651 through the ice making section 2220 fall down in the chute 2652 and exit to the inside of the ice tank 2270.

[0126] The chute 2652 includes a recessed portion 2653 in a middle with respect to the upper-bottom direction. The recessed portion 2653 is recessed toward the ice making section 2220 (the outside). An UV detection device 2674 that detects ultraviolet light is arranged in the recessed portion 2653. An UV sterilization device 2673 that irradiates ultraviolet light to sterilize ice is disposed on an inner wall of the chute 2652 so as to be opposite the UV detection device 2674.

[0127] According to such an ice making machine 2600, the ice that falls in the chute 2652 can be sterilized by the UV sterilization device 2673 and the falling of the ice can be detected by the UV detection device 2674. Accordingly, it can be determined whether the ice making machine 2600 is in an abnormal state or not. For example, if ice is excessively stored in the ice tank 2270 or ice cannot fall inside the chute 2652, the ice making machine 2600 is in an abnormal state. When the ice falls inside the chute 2652, small broken ice pieces and water are splashed. With the UV detection device 2674 being arranged in the recessed portion 2653, the splashed small ice pieces and water do not stick to the UV detection device 2674. Therefore, ultraviolet light is less likely to be insufficiently irradiated or not to be detected by the UV detection device 2674 and operations of the devices are not hindered.

[0128] An ice detection device 2675 is disposed near a lower end 2652D of the chute 2652. The ice detection device 2675 detects a height of the ice stored in the ice tank 2270. According to such an ice making machine 2600, it can be determined more precisely whether the ice making machine 2600 is in an abnormal state such as an excessive amount of ice stored in the ice tank 2270.

[0129] Other than the above embodiments, an ice making machine may include a UV sterilization device in a recessed portion and include a UV detection device so as to be opposite the UV sterilization device. Furthermore, other than the above embodiments, an ice detection device may be disposed in the spout. Furthermore, a control section may inform a user using an ice making machine of an abnormality of the machine with noise of a buzzer when no excessive amount of ice is stored in an ice tank and the UV detection device does not detect falling of ice with the ice making section being activated.

<Ninth Modification>

[0130] Next, a ninth modification according to the technology described herein will be described with reference to FIG. 24. In this modification, the same symbols are used for the components same as those of the above embodiments, and configurations, operations, and effects same as those of the above embodiments will not

be described. An ice making machine 2700 includes the upper section 2201 and a lower section 2702. The upper section 2201 includes the ice making section 2220 and the transfer cavity 2250. The lower section 2702 is disposed under the upper section 2201 and includes an ice tank 2770. An ice tank-side UV sterilization device 2773 and a UV detection device 2774 are mounted on an upper wall 2770A of the lower section 2702. The ice tank-side UV sterilization device 2773 irradiates ultraviolet light to sterilize ice. The UV detection device 2774 detects ultraviolet light. With such a configuration, a height of ice 2000I stored in the ice tank 2770 can be detected. The ice tank-side UV sterilization device 2773 according to this modification is included in addition to the UV sterilization device (refer to the fourth embodiment) that is disposed in the spout 2251.

[0131] The lower section 2702 includes a door 2703 that pivotably opens outward. The door 2703 includes a holder 2704 at an upper edge. The holder 2704 extends in a front-back direction on the paper sheet. A user of the ice making machine 2700 holds the holder 2704 and opens the door 2703 such that the user can take out the ice 2000I stored in the ice tank 2770 with a scoop. The holder 2704 extends upward from an upper edge of the door 2703 and is curved to extend outward and downward and have a hook cross-sectional shape at an extended end thereof. A holder-side UV sterilization device 2775 is disposed at a lower end of the holder 2704. The holder-side UV sterilization device 2775 irradiates ultraviolet light toward an upper side (an upper end of the holder 2704). The holder-side UV sterilization device 2775 has an elongated shape that extends in the front-back direction on the paper sheet. LEDs that irradiate ultraviolet light are arranged on a belt-shaped board. A bar-light type LED module and a tape-light module including a flexible board can be used for the holder-side UV sterilization device 2775. Portions of such a holder-side UV sterilization device 2775 that ultraviolet light passes are preferably made of material having relatively high ultraviolet transmittance such as quartz glass and calcium fluoride. The holder-side UV sterilization device 2775 may not be disposed at the lower end of the holder 2704 but may be disposed at the upper end of the holder 2704. According to such a configuration, bacterial growth on the holder 2704 that is held by a user can be prevented and the holder 2704 is kept clean. The holder-side UV sterilization device 2775 may further include LEDs that irradiate visible light (visible light LEDs). In this configuration, the control section may vary colors and brightness of the visible LEDs according to the condition of the ice making machine 2700 (ice is being made, the ice tank being filled with ice, machine stops due to an error, or necessity of cleaning the inside).

<<Sixth Embodiment>>

[0132] The technology described herein will be described with reference to FIGS. 25 to 31. The symbols

of F, Rr, L, R, U, and D illustrated in each drawing represent a front side and a rear side with respect to a front-rear direction of an ice making machine, a left side and a right side with respect to a width direction, and an upper side and a lower side with respect to the vertical direction, respectively. The directions are defined for convenience and are not limited to those described in the drawings.

<Ice Making Machine>

[0133] As illustrated in FIG. 25, an ice making machine 3001 according to this embodiment includes a case 3003 having a box shape as a whole. As illustrated in FIG. 26, the ice making machine 3001 includes an ice making section 3005, an ice storing section 3030, a water supply and discharge mechanism 3040, and a control device 3100 (refer to FIG. 27) in the case 3003. The ice making section 3005 includes a freezing unit 3010 and an ice making unit 3020. With a cylinder 3021 of the ice making unit 3020 being cooled by the freezing unit 3010 from outside, an inner surface of the cylinder 3021 is ready for making ice. Ice making water is supplied to the inside of the cylinder 3021 by the water supply and discharge mechanism 3040 and ice is made. The produced ice is transferred to the ice storing section 3030. An operation panel 3150 is mounted on a front surface of the case 3003 and a user performs instructions and settings of various kinds of operations with the operation panel 3150. Ventilation holes 3004 are provided in an upper surface of the case 3003 such that air flow occurs within the freezing unit 3010. Each of the components will be described below.

[0134] First, the freezing unit 3010 is a component for cooling the cylinder 3021 of the ice making unit 3020 to predetermined ice making temperature, which will be described later. As illustrated in FIG. 26, the freezing unit 3010 includes a compressor 3011, a condenser 3012, an expansion valve 3013, an evaporation pipe 3014, and a refrigerant pipe 3015. Refrigerant flows through the refrigerant pipe 3015 to circulate among the compressor 3011, the condenser 3012, the expansion valve 3013, and the evaporation pipe 3014. The compressor 3011 compresses refrigerant gas and sends the compressed refrigerant gas to the refrigerant pipe 3015. The compressed refrigerant gas that is sent to the refrigerant pipe 3015 is cooled by a fan 3016, which is disposed adjacent to the condenser 3012, at a constant pressure and liquefied by the condenser 3012. The liquefied and compressed refrigerant is decompressed by the expansion valve 3013 to be expanded. The evaporation pipe 3014 is a portion of the refrigerant pipe 3015 that is on a downstream side with respect to the expansion valve 3013. The evaporation pipe 3014 is wound around an outer surface of the cylinder 3021 without having any space between adjacent portions of the evaporation pipe 3014. As the expanded liquefied refrigerant is vaporized in the evaporation pipe 3014, the evaporation pipe 3014 absorbs heat from a surface of the cylinder 3021 to cool the cylinder

3021. The refrigerant gas vaporized in the evaporation pipe 3014 is transferred to the compressor 3011 again via the refrigerant pipe 3015.

[0135] With such a freezing cycle, the freezing unit 3010 is configured to cool an ice making portion of the cylinder 3021 (a portion where the refrigerant pipe 3015 is wound) to the ice making temperature. The freezing unit 3010 includes a thermal insulation member 3018, a dryer, which is not illustrated, and temperature sensors, which are not illustrated. The evaporation pipe 3014 is covered with the thermal insulation member 3018 from outside and this increases cooling effects of the cylinder 3021. The dryer is disposed on a downstream side with respect to the condenser 3012 and removes moisture from the freezing unit 3010. One temperature sensor is disposed at an end of the evaporation pipe 3014 and another temperature sensor is disposed at a position that is on a downstream side with respect to the condenser 3012 and an upstream side with respect to the dryer. The temperature sensors detect temperatures of the refrigerant at the respective positions. In the freezing unit 3010, the compressor 3011, the condenser 3012, the expansion valve 3013, the fan 3016, the dryer, and the temperature sensors are electrically connected to the control device 3100.

[0136] The ice making unit 3020 is a component for making ice. As illustrated in FIG. 26, the ice making unit 3020 includes the cylinder 3021, an auger 3022, a forming member 3023, a sealing portion 3026, and a driving section 3027. The cylinder 3021 is made of metal such as stainless steel and has a tubular shape. The cylinder 3021 is disposed such that an axis of the cylinder 3021 extends along the upper-bottom direction. The evaporation pipe 3014 of the freezing unit 3010 is wound around an outer peripheral surface of the cylinder 3021 except for upper and lower end portions of the cylinder 3021 with respect to the upper-bottom direction. The evaporation pipe 3014 is closely and tightly wound around the cylinder 3021 without having a space between adjacent portions of the evaporation pipe 3014. Thus, the above-described ice making portion is obtained. The cylinder 3021 includes an inlet port and an outlet port in side wall of a lower end of the cylinder 3021. The water supply and discharge mechanism 3040, which will be described later, is connected to the inlet port and the outlet port such that ice making water can be supplied to and discharged from the cylinder 3021.

[0137] The auger 3022 is a cutter and includes a rotary shaft portion 3022A having a columnar shape and a spiral scraping blade 3022B on a peripheral surface of the rotary shaft portion 3022A. The auger 3022 is disposed in the cylinder 3021 such that a rotation axis of the rotary shaft portion 3022A is coaxial with a center axis of the cylinder 3021. The scraping blade 3022B protrudes from a portion of the peripheral surface of the rotary shaft portion 3022A corresponding to the ice making portion of the cylinder 3021 toward an inner surface of the cylinder 3021. The scraping blade 3022B has a protrusion dimen-

sion so as not to reach the cylinder 2021. A lower end of the auger 3022 is connected to the driving section 3027. Specifically, the driving section 3027 includes a geared motor, a gear system, and an output shaft, which are not illustrated. The lower end of the auger 3022 is mechanically connected to the output shaft. The sealing portion 3026 includes a rotary ring member, a fixed ring member, and a secondary sealing member. The rotary ring member is fitted to the auger 3022 so as to surround a lower end portion of the auger 3022 from outside. The fixed ring member is fitted to the output shaft from outside and fixed to the driving section 3027. The secondary sealing member stops water in a watertight manner. The sealing portion 3026 functions as a mechanical sealing member that prevents water from leaking between a water supply area inside the cylinder 3021 and the driving section 3027 without losing rotation power. As the geared motor of the driving section 3027 is driven, power is transmitted to the output shaft via the gear system and the auger 3022 rotates. As the auger 3022 rotates, ice made on the inner surface of the cylinder 3021 is scraped off by the scraping blade 3022B sequentially and scraped sherbet-like ice is placed on a surface of the spiral scraping blade 3022B and transferred upward in the cylinder 3021.

[0138] The forming member 3023 is arranged in an upper portion of the cylinder 3021. The forming member 3023 has a tubular shape. The forming member 3023 receives an upper portion of the auger 3022 therein such that the auger 3022 is rotatable. The forming member 3023 and the cylinder 3021 form the ice, which is transferred by the auger 3022, into a certain shape. The forming member 3023 includes grooves on an outer peripheral surface thereof. The grooves extend along an axial direction of the cylinder 3021 and are configured as ice forming cavities. The sherbet-like ice that is transferred upward by the auger 3022 is pushed into the ice forming cavities that are defined by the inner surface of the cylinder 3021 and the outer peripheral surface of the forming member 3023 and dehydrated and formed into a columnar shape. The driving section 3027 of the ice making unit 3020 is electrically connected to the control device 3100.

[0139] As illustrated in FIG. 26, the ice storing section 3030 of this embodiment is disposed above the ice making unit 3020. The ice storing section 3030 has a circular cylindrical shape and mainly includes a stocker 3031 and a cover 3033. The stocker 3031 has a bottomed box shape and opens upward. The cover 3033 covers an upper opening of the stocker 3031. Walls of the stocker 3031 and the cover 3033 include thermal insulation material therein and this provides thermal insulation properties. Accordingly, the ice stored in an ice storing space defined by the stocker 3031 and the cover 3033 is less likely to be melted. The ice storing section 3030 is connected to the cylinder 3021 of the ice making section 3005 in a watertight manner. A bottom of the stocker 3031 is connected to an upper portion of the cylinder 3021 in a watertight manner. The ice formed via the ice

forming cavities is transferred to the stocker 3031 by the auger 3022. The bottom of the stocker 3031 includes a discharge hole 3032 and a duckboard portion 3037 is on the bottom of the stocker 3031. The discharge hole 3032 is in a peripheral edge portion of the bottom. A surface of the bottom is sloped downwardly toward the discharge hole 3032. The duckboard portion 3037 is a disk-like shape having through holes. The duckboard portion 3037 supports the ice at an upper position to be away from the bottom. Thus, the ice is not contacted with the water stored in a bottom section. The duckboard portion 3037 extends upward from the outer periphery of the cylinder 3021 and extends downward toward the outer periphery of the bottom along the slope of the bottom.

[0140] An agitator 3036 is disposed in the stocker 3031. The agitator 3036 is coaxially fixed to the upper end portion of the auger 3022 so as to be inserted through a center portion of the duckboard portion 3037. The agitator 3036 is a rotary member that includes a shaft that is connected to the auger 3022 and agitating bars (one example of an agitating member) that extend from the shaft toward the wall surfaces of the stocker in various directions. A diameter of the shaft increases near a lower end of the shaft and the shaft has a tapered surface at the lower end. The ice pieces that are formed into a columnar shape in the forming member 3023 is transferred by the auger 3022 and pushed toward the tapered surface of the agitator 3036. Then, the columnar-shaped ice pieces are cut into small pieces having a predetermined length and stored on the duckboard portion 3037. With the agitator 3036 being rotated according to the rotation of the auger 3022, the ice stored in the stocker 3031 is agitated by the agitating bars. This suppresses the ice pieces from being melted and becoming a large ice block.

[0141] An ice discharge opening 3034C and an electric shutter 3034B are provided on a front surface side of the stocker 3031. The operation panel 3150 includes an ice discharge button 3034A. The ice discharge button 3034A and the electric shutter 3034B are electrically connected to the control device 3100. With the ice discharge button 3034A being pressed by a user, an ice discharge instruction is transferred to the control device 3100. The control device 3100 drives the driving section 3027 for a predetermined time and opens the electric shutter 3034B. Accordingly, the agitator 3036 is rotated and the ice inside the stocker 3031 moves along the upper surface of the duckboard portion 3037 to the ice discharge opening 3034C and the ice is discharged through the ice discharge opening 3034C.

[0142] An ice amount sensor 3035 of a disk-like shape is mounted on the cover 3033. The ice amount sensor 3035 is electrically connected to the control device 3100. The ice amount sensor 3035 is hung on the middle of the cover 3033. The ice amount sensor 3035 is movable in the upper-bottom direction in an upper section of the stocker 3031. The ice amount sensor 3035 is pushed upward as the amount of ice in the stocker 3031 increases. When the amount of ice becomes full and reaches a

predetermined level, a reed switch, which is not illustrated, is turned on and a full condition is detected.

[0143] The water supply and discharge mechanism 3040 is a component configured to supply and discharge water such as ice making water and cleaning water to and from the ice making section 3005. As illustrated in FIG. 26, the water supply and discharge mechanism 3040 generally includes a water tank 3041 that stores water, a water supply cavity and a water discharge cavity, which will be described later, and a valve. The water tank 3041 includes a case 3042 and a cover 3043. The case 3042 is a rectangular parallelepiped container that opens upward. The cover 3043 covers an opening of the case 3042. An overflow discharge hole is provided at a corner section of the case 3042. When a level of water in the case 3042 becomes above the predetermined water level, water is discharged through the overflow discharge hole.

[0144] More specifically, a first water supply cavity S1 is connected to the cover 3043 of the water tank 3041 via a water supply valve Vs. Water can be supplied from an external source such as a water pipe to the water tank 3041 via the first water supply cavity S1. The water tank 3041 is disposed on a laterally upper side with respect to the cylinder 3021. A water through hole in a bottom of the water tank 3041 is connected to the inlet port of the cylinder 3021 via a second water supply cavity S2. According to such a configuration, water is supplied such that no difference is created between a hydraulic head in the water tank 3041 and a hydraulic head in the cylinder 3021.

[0145] A first water discharge cavity D1 is connected to the outlet port of the cylinder 3021. The first water discharge cavity D1 is continuous to a water discharge cavity D4 via a discharge valve Vd. Water inside the first water discharge cavity D1 is transferred to the water discharge cavity D4 by opening the discharge valve Vd. A second water discharge cavity D2 is connected to an overflow water discharge opening 3045 of the water tank 3041. The second water discharge cavity D2 is continuous to the water discharge cavity D4 at a downstream side end thereof. A third water discharge cavity D3 is connected to the discharge hole 3032 of the ice storing section 3030. The third water discharge cavity D3 is continuous to the water discharge cavity D4 at a downstream side end thereof. A check valve Vt is disposed on a downstream side with respect to a joint portion of the first water discharge cavity D1, the second water discharge cavity D2, and the third water discharge cavity D3. Discharged water from the ice making machine 3001 is discharged to an external discharge cavity via the water discharge cavity D4.

[0146] A water amount sensor 3048 and an ultraviolet light irradiation device 3050 are mounted on the cover 3043. The water amount sensor 3048 according to this embodiment is an ultrasonic sensor and outputs ultrasonic sound waves toward a bottom of the water tank 3041 and receives ultrasonic sound waves. The water

amount sensor 3048 detects an amount of water (a volume level) stored in the water tank 3041 in a contactless manner based on a time difference between the output of the ultrasonic sound waves and the reception of the ultrasonic sound waves that reflect off a water surface of the water stored in the water tank 3041. The water amount sensor 3048 is disposed at a position slightly away upward from the inner surface of the cover 3043. The water amount sensor 3048 is configured to detect precisely the ultrasonic sound waves that reflect off a water surface corresponding to a highest water level in the water tank 3041.

[0147] The ultraviolet light irradiation device 3050 is a component that emits ultraviolet light. As a light source of ultraviolet light, at least one of a discharge lamp such as a mercury lamp and a metal halide lamp, and an ultraviolet light emitting diode (UV-LED) can be used. Ultraviolet light that is emitted by the ultraviolet light irradiation device 3050 has a wavelength of about 200 nm or longer and 300 nm or shorter and has sterilizing effects. Typically, the ultraviolet light preferably has a wavelength of about 220 nm or longer and 280 nm or shorter, and preferably include a greater amount of deep ultraviolet rays of 253 nm or longer and 285 nm or shorter. The ultraviolet light irradiation device 3050 includes a deep ultraviolet rays UV-LED as a light source. The ultraviolet light irradiation device 3050 can irradiate ultraviolet light downward in a wide range and ultraviolet light can be irradiated to a large area inside the water tank 3041. Accordingly, the inside of the water tank 3041 and the water stored in the water tank 3041 can be surely irradiated with ultraviolet light. Components of the ice making machine 3001 that are disposed in the area that is to be irradiated with ultraviolet light are made of synthetic resin having weatherproof properties such as acrylic resin, polycarbonate, and vinyl chloride or metal.

[0148] The operation panel 3150 includes a display section 3152 (refer to FIG. 27) and an input section 3154 (refer to FIG. 27). Status information of each section of the ice making machine 3001 and operation conditions of the ice making machine 3001 are displayed on the display section 3152. Instructions or setting of various operations of the ice making machine 3001 can be performed with the input section 3154. The operation panel 3150 may be detachably mounted in the ice making machine 3001. The display section 3152 may include a liquid crystal display or an electro luminescence (EL) display and displays a text or images according to the instructions from the control device 3100. The display section is one example of informing means of the present technology. The input section 3154 may include an operation button, a key board, or a touch panel and is a user interface with which instructions to the control device 3100 are input by a user. A user can input information related to the condition of the ice making machine 3001, operation conditions, and operation instructions via the input section. The ice discharge button 3034A is one example of the input section 3154.

[0149] In the above ice making machine 3001, the control device 3100 controls operations of each of the components included in the ice making section 3005, the ice storing section 3030, and the water supply and discharge mechanism 3040. A configuration of the control device 3100 is not particularly limited. For example, as illustrated in FIG. 27, the control device 3100 includes a microcomputer, which includes an interface (I/F), a central processing unit (a CPU), a ROM, a RAM, a memory section 3000M, and a timer 3000T, as a main component. The control device 3100 is connected to each of the components of the ice making machine 3001 such that data transmission can be performed between the control device 3100 and each of the components of the ice making machine 3001 with a wired or wireless manner. Various kinds of information are transmitted to an external device or received from an external device via the interface. The CPU performs operations according to instructions from a control program. The ROM stores the program that is performed by the CPU. The RAM is used as a working area where the program is performed. The memory section 3000M stores various kinds of information. The timer 3000T has function of a counter. The control device 3100 is arranged in a control box that is disposed behind the stocker 3031 and not illustrated. The control device 3100 further includes an ice making operation control section 3110 and an ultraviolet light irradiation control section 3120. A portion or all of each of the ice making operation control section 3110 and the ultraviolet light irradiation control section 3120 may be configured as a hardware such as a processor or a circuit or may be functionally achieved by a program performed by the CPU.

[0150] The ice making operation control section 3110 controls each of the components of the ice making machine 3001 to perform an ice making operation as described below.

[0151] First, the freezing unit 3010 is driven to cool the ice making portion of the cylinder 3021 to the predetermined ice making temperature. Next, it is checked with the ice amount sensor 3035 whether the amount of ice in the stocker 3031 is full, that is, whether the amount of ice in the stocker 3031 reaches an ice making limit amount. If the stocker 3031 is not full, the ice making unit 3020 and the water supply and discharge mechanism 3040 are driven to make ice until the ice amount sensor 3035 detects a full condition of the stocker 3031. Specifically, with the water amount sensor 3048 detecting the water level of the water stored in the water tank 3041 and the ice amount sensor 3035 detecting the amount of ice stored in the stocker 3031, the water supply valve Vs is opened with the water discharge valve Vd being closed. Thus, water is supplied to the water tank 3041 until the water level in the water tank reaches an ice making highest water level. If the supplying of water is finished, the water supply valve Vs is closed and the ice making unit 3020 (the driving section 3027) is driven. During the driving operation, if the water level is lowered to an ice making lowest water level, the water supply valve Vs is opened,

and if the water level increased and reaches the ice making highest water level, the water supply valve Vs is closed. Such a water level control operation is continued during the driving operation. The above-described ice making operation is continued until the ice amount sensor 3035 detects the full condition of the stocker 3031. While the ice amount sensor 3035 detects the full condition of the stocker 3031, the ice making operation is not performed. Then, the ice is used, and if the ice amount sensor 3035 detects that the amount of ice stored in the stocker 3031 reaches a predetermined operation restart level, the ice making operation is restarted. The ice making operation control section 3110 according to this embodiment is configured to start ice making operation based on the time counted by the timer 3000T according to an ice making operation program or start ice making operation in response to user's input of instructions for starting the operation via the input section.

[0152] The ultraviolet light irradiation control section 3120 controls an irradiation amount of UV light emitted by the ultraviolet light irradiation device 3050. The ultraviolet light irradiation device 3050 varies the amount of ultraviolet light to be emitted according to the supplied current amount. The ultraviolet light irradiation control section 3120 supplies high speed pulse current to the ultraviolet light irradiation device 3050 to drive the ultraviolet light irradiation device 3050. The ultraviolet light irradiation control section 3120 changes a pulse width of the supplied pulse current to control (adjust) the amount of ultraviolet light emitted by the ultraviolet light irradiation device 3050. As illustrated in FIG. 28, for example, the ultraviolet light irradiation control section 3120 according to this embodiment includes a current control section 3121 and an electronic circuit section 3122 (a section defined by a dotted line in FIG. 28). The electronic circuit section 3122 that is mounted on a board is disposed adjacent to the ultraviolet light irradiation device 3050. The ultraviolet light irradiation device 3050 is electrically connected to an external driving power supply 3009 of the ice making machine 3001 via the electronic circuit section 3122. The electronic circuit section 3122 is electrically connected to the current control section 3121 and configured to be driven according to signals transmitted from the current control section 3121.

[0153] An electronic circuit related to the ultraviolet light irradiation control section 3120 will be described. As illustrated in FIG. 28, power supply lines extending from the driving power supply 3009 generally include a first power supply line LB1 and a second power supply line LB2. A main section of the electronic circuit section 3122 and the ultraviolet light irradiation device 3050 are supplied with power from the driving power supply 3009 via the second power supply line LB2. A switch 3123 (a contact portion) is disposed on the second power supply line LB2. The second power supply line LB2 is connected or disconnected by the switch 3123. The ice making operation control section 3110 of the control device 3100, the current control section 3121 of the ultraviolet light irradiation control section 3120 will be described.

ation control section 3120, an electromagnetic coil C that operates opening and closing of the switch 3123, and other components of the ice making machine 3001 are provided with power from the driving power supply 3009 via the first power supply line LB1. A switch SW (for example, a main power supply switch) that is opened and closed by a mechanical operation is disposed on the first power supply line LB1. With the switch SW being ON, the control device 3100 is supplied with power and this enables the ice making machine 3001 to be operated.

[0154] A switching element Q3 of the electronic circuit section 3122 is a load switch that switches between ON and OFF of current flow to a contact relay that includes the switch 3123 and the electromagnetic coil C. In this embodiment, an N-channel FET (field effect transistor) is used as the switching element Q3 and the switching element Q3 is disposed on a ground side of the electromagnetic coil C. A drain of the switching element Q3 is connected to the electromagnetic coil C. A source of the switching element Q3 is connected to a ground and a gate of the switching element Q3 is connected to the current control section 3121. If the switching element Q3 turns ON (becomes electrically conductive) in response to a control signal (ON signal) from the current control section 3121, a current is supplied to the electromagnetic coil C and the switch 3123 is closed. Accordingly, components of the electronic circuit section 3122 other than the switching element Q3 and the ultraviolet light irradiation device 3050 are supplied with power via the second power supply line LB2. This enables the ultraviolet light irradiation device 3050 to irradiate ultraviolet light. If the switching element Q3 turns OFF (becomes electrically disconnected) in response to a control signal (OFF signal) from the current control section 3121, no current is supplied to the electromagnetic coil C and the switch 3123 is opened. The supplying of power from the power supply to the ultraviolet light irradiation device 3050 is stopped and ultraviolet light irradiation by the ultraviolet light irradiation device 3050 is stopped.

[0155] The electronic circuit section 3122 according to this embodiment includes an H-type mixed bridge circuit 3122A, a PWM control circuit 3122B, a current detection resistance R, an amplifier AP, in addition to the switching element Q3.

[0156] The H-type mixed bridge circuit 3122A includes two switching elements Q1, Q2 and two regenerative diodes Dr1, Dr2. The switching elements Q1, Q2 are N-channel FETs (field electric transistors). The H-type mixed bridge circuit 3122A is connected in parallel to the second power supply line LB2. The switching element Q1 is connected to an upper arm of phase 1 and the regenerative diode Dr1 is connected to a lower arm of phase 1. The regenerative diode Dr2 is connected to an upper arm of phase 2 and the switching element Q2 is connected to a lower arm of phase 2. More specifically, a drain of the switching element Q1 is connected to the second power supply line LB2. A cathode of the regenerative diode Dr1 is connected to a source of the switch-

ing element Q1 and an anode of the regenerative diode Dr1 is connected to a ground (phase 1). A cathode of the regenerative diode Dr2 is connected to the second power supply line LB2. A drain of the switching element Q2 is connected to an anode of the regenerative diode Dr2 and a source of the switching element Q2 is connected to a ground (phase 2).

[0157] A current detection resistance R and the ultraviolet light irradiation device 3050 are connected in series to a load branch line between a middle connection point a that is between the upper arm and the lower arm of phase 1 and a middle connection point b that is between the upper arm and the lower arm of phase 2. The amplifier AP is configured as a difference circuit. The amplifier AP detects a voltage drop at the current detection resistance R and outputs a current detection signal, which represents a value of a load current flowing through the ultraviolet light irradiation device 3050, to the PWM control circuit 3122B.

[0158] The PWM control circuit 3122B functions as a driver that turns ON and OFF switches of the switching elements Q1, Q2. The PWM control circuit 3122B includes an input terminal that is connected to the current control section 3121 and two output terminals that are connected to gates of the switching elements Q1, Q2, respectively. The PWM control circuit 3122B includes a power supply terminal that is connected to the second power supply line LB2. When a switch section of the switch 3123 is closed, power is supplied to the PWM control circuit 3122B from the driving power supply 3009. The switching elements Q1, Q2 turn ON and OFF according to a high PWM signal and a low PWM signal. When the switching elements Q1, Q2 turn ON (become electrically conductive), a current from the driving power supply 3009 flows to the earth through the switching element Q1, the current detection resistance R, the ultraviolet light irradiation device 3050, and the switching element Q2 in this order. When the switching elements Q1, Q2 turn OFF (become electrically disconnected), a current flows from the earth to the driving power supply 3009 through the regenerative diode Dr1, the current detection resistance R, the ultraviolet light irradiation device 3050, and the regenerative diode Dr2 in this order.

[0159] The PWM control circuit 3122B receives information related a target current value Ia that is to be supplied to the ultraviolet light irradiation device 3050 according to the condition of the ice making machine 3001. The PWM control circuit 3122B sends to the switching elements Q1, Q2 the PWM signal that makes the current detection signal transferred from the amplifier AP to be a target current detection signal for achieving the target current value Ia. Namely, the PWM control circuit 3122B performs a high-speed switching for the power supplied to the ultraviolet light irradiation device 3050 and sends to the switching elements Q1, Q2 the PWM signal that is modified with the pulse width modulation such that the current flowing in the ultraviolet light irradiation device 3050 is equal to the target current value Ia. Specifically,

the high-speed switching is preferably performed at a cycle of 0.01 μ S to 100 μ S. If the load current value flowing in the ultraviolet light irradiation device 3050 becomes smaller than the target current value I_a and the current detection signal becomes smaller than the target current detection signal, the pulse width of the PWM signal is increased (a high-level time is increased) to increase the ON time of the switching elements Q1, Q2. If the load current value becomes greater than the target current value I_a and the current detection signal becomes greater than the target current detection signal, the pulse width of the PWM signal is reduced (a high-level time is reduced) to reduce the ON time of the switching elements Q1, Q2. Thus, the load current flowing in the ultraviolet light irradiation device 3050 can be controlled to be a desired current value.

[0160] As described previously, the current control section 3121 controls the switch 3123 (the switching element Q3) and the PWM control circuit 3122B that are related to driving of the ultraviolet light irradiation device 3050. Specifically, according to the state of the ice making machine 3001, the current control section 3121 outputs to the PWM control circuit 3122B the information related to the target current value I_a that is to be supplied to the ultraviolet light irradiation device 3050. A required amount of ultraviolet light depends on the installation environment of the ice making machine 3001 and the running state of the ice making machine 3001. Therefore, the current control section 3121 varies the target current value I_a to be instructed to the PWM control circuit 3122B according to the installation environment of the ice making machine 3001 that is previously inputted to the ice making machine 3001 by a user and the running state of the ice making machine 3001.

[0161] For instance, when the ice making machine 3001 performs an ice making operation, it is desirable that water stored in the water tank 3041 is irradiated with a necessary amount of the ultraviolet light by the ultraviolet light irradiation device 3050. Accordingly, the ice making water can be sterilized with UV light and ice can be made with using the ice making water sterilized with UV light. On the other hand, when the ice making machine 3001 does not perform the ice making operation (including a standby state), further UV sterilization is not necessary for the ice making water that has been sterilized with UV light and it is effective if the sterilized state of the ice making water stored in the water tank 3041 can be maintained. Therefore, the current control section 3121 is configured to switch the control mode between a HIGH mode and a LOW mode depending on the ice making state of the ice making machine 3001. In the HIGH mode, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 is relatively increased. In the LOW mode, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 is relatively reduced. In other words, depending on the ice making state of the ice making machine 3001, the target current value I_a to be instructed to the PWM control

circuit 3122B is varied between a relatively high value and a relatively low value in the HIGH mode (H) and the LOW (L) mode.

[0162] Depending on the installation environment of the ice making machine 3001, the amount of ultraviolet light necessary for sterilizing the water supplied to the water tank 3041 may be varied. FIG. 29 schematically illustrates target current values I_a that enable the ultraviolet light irradiation device 3050 to irradiate the ultraviolet light necessary for sterilizing the ice making water in the ice making machine 3001 in the environments A to C where the ice making machine 3001 is installed.

<Environment A> For instance, in developing countries having poor environmental sanitation of the public water system or in areas where life water always contains bacteria, a relatively great amount of ultraviolet light is necessary to sterilize water. Therefore, as illustrated with Environment A in FIG. 29, the current control section 3121 sets the target current value I_a in a range where a greater amount of ultraviolet light can be obtained. With such a target current value I_a , the current control section 3121 switches the control mode between the HIGH mode and the LOW mode when water is being supplied and water is not being supplied during the ice making operation.

<Environment B> In developed countries having good environmental sanitation of the public water system, a relatively small amount of ultraviolet light is enough for sterilizing water. Therefore, as illustrated with Environment B, the current control section 3121 sets the target current value I_a in a range where a relatively smaller amount of ultraviolet light can be obtained compared to Environment A. With such a target current value I_a , the current control section 3121 switches the control mode between the HIGH mode and the LOW mode when water is being supplied and water is not being supplied during the ice making operation.

<Environment C> In Japan having excellent environmental sanitation of the public water system, water supplied by the public water system is clean enough for drinking water and water appropriately contains chloride for sterilization. In such an environment, a necessary amount of ultraviolet light to be irradiated to water transferred to the water tank 3041 is relatively small. Therefore, in Environment C, the amount of ultraviolet light for sterilizing water that is supplied to the water tank 3041 during the ice making operation is relatively small. However, while the ice making operation is not performed (including the standby state), the water stays inside the water tank 3041 and bacteria is likely to grow in the water and a relatively large amount of ultraviolet light may be preferably irradiated to the water. Therefore, as illustrated with Environment C, the current control section 3121 sets the target current value I_a in a

range where a relatively smaller amount of ultraviolet light can be obtained compared to Environment A and Environment B. With such a target current value I_a , the current control section 3121 switches the control mode between the HIGH mode and the LOW mode when water is not being supplied and water is being supplied during the ice making operation.

<Environment D> In a configuration that purified water that passes through a water purifier is supplied to the water tank 3041, a user may keep using a filter of the purifier beyond a predetermined filter life (a filter life related to the amount of water passing through the filter). In such a case, a small amount of ultraviolet light is enough for sterilizing purified water until the filter of the water purifier reaches the filter life; however, the water stored in the water tank 3041 is preferably sterilized with a relatively large amount of ultraviolet light after the filter reaches the filter life and until the filter is replaced with new one. Therefore, when the water purifier is used and the filter does not reach the filter life in any of Environments A, B, and C, the current control section 3121 slightly reduces the target current value I_a (for instance, -30% to -10%) and performs an operation in the LOW mode. When the filter reaches the filter life, the current control section 3121 slightly increases the target current value I_a (for instance, +10% to +30%) and performs an operation in the HIGH mode.

[0163] The target current values I_a in the HIGH mode and the LOW mode may be varied depending on the type of the light source and the number of light sources included in the ultraviolet light irradiation device 3050 and the amount of water used by the ice making machine 3001 and are not specified exactly. For instance, in Environment B without using a water purifier, the target current values I_a are set such that the irradiation intensity in the HIGH mode is from 0.1 mW/cm² to 1000 mW/cm² and the irradiation intensity in the LOW mode is from 0.1 μW/cm² to 1000 μW/cm². Furthermore, for instance, in Environment B with using a water purifier, the target current values I_a are set such that the irradiation intensity in the HIGH mode is from 0.13 mW/cm² to 1300 mW/cm² and the irradiation intensity in the LOW mode is from 0.97 μW/cm² to 970 μW/cm².

[0164] Relation between the installation environment of the ice making machine 3001 (for instance, one of Environments A to C and with or without using a water purifier) and the target current values I_a in the HIGH mode and the LOW mode in the installation environment may be included in a reference table and previously stored in the memory section M. The current control section 3121 can determine a target current value I_a according to the installation environment of the ice making machine 3001 with reference to the reference table stored in the memory section M. The target current values I_a in the HIGH mode and the LOW mode may be determined at the starting of a first ice making operation after a user changes (inputs)

the installation environment information of the ice making machine 3001. If the installation environment information is not changed, the target current value I_a that is used in a previous operation may be used.

<Control Process 1-1>

[0165] An example of a process of controlling the ultraviolet light irradiation device 3050 performed by the current control section 3121 will be described with reference to FIG. 30. In the following, a control process in Environment A, B will be described.

[0166] If the switch SW of the ice making machine 3001 turns on and control by the control device 3100 is started, with reference to the reference table stored in the memory section 3000M, the current control section 3121 sets the target current values I_a in the HIGH mode and the LOW mode corresponding to the installation environment of the ice making machine 3001 based on the installation environment of the ice making machine 3001 that has been previously input by a user (S3001).

[0167] Thereafter, the current control section 3121 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light (S3002). At this time, the target current value I_a is a relatively lower value of the LOW mode and the amount of ultraviolet light that is irradiated by the ultraviolet light irradiation device 3050 is relatively suppressed but is appropriate for sterilizing the water tank 3041.

[0168] After step S3002, if the ice making operation control section 3110 starts the ice making operation and the water supply valve V_s is opened with the freezing unit 3010 being driven (Yes at S3003), the current control section 3121 switches the target current value I_a to a relatively high value of the HIGH mode (S3004). This increases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 and a sufficient amount of ultraviolet light can be irradiated to the water supplied to the water tank 3041 to perform UV sterilization. If the ice making operation is not started (No at S3003), the UV irradiation in the LOW mode will be continued.

[0169] If the water level of the water in the water tank 3041 reaches the ice making highest water level during the ultraviolet light irradiation in the HIGH mode, the water supply valve V_s is opened with the freezing unit 3010 and the ice making unit being driven (Yes at S3005). The current control section 3121 switches the target current value I_a to the relatively low value of the LOW mode (S3006). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 and ultraviolet light of an amount that is sufficient to keep a UV sterilization condition is irradiated to the water stored in the water tank 3041. Therefore, the ultraviolet light irradiation device 3050 (the light source) can obtain a longest life span with maintaining the UV sterilization condition.

[0170] After step S3006, the process returns to step S3003 again. Responding to opening and closing of the water supply valve Vs according to water level control of water in the water tank 3041 during the ice making operation, the switching control between the HIGH mode and the LOW mode (steps S3003 to S3006) will be performed repeatedly.

<Control Process 1-2>

[0171] A control process of the current control section 3121 in Environment C is illustrated in FIG. 31. If the switch SW of the ice making machine 3001 turns on and control by the control device 3100 is started, with reference to the reference table stored in the memory section 3000M, the current control section 3121 sets the target current values Ia in the HIGH mode and the LOW mode according to the installation environment of the ice making machine 3001 based on the installation environment of the ice making machine 3001 that has been previously input by a user (S3011). As illustrated in FIG. 29, the target current value Ia set for the ice making machine 3001 installed in Environment C is relatively lower than the values in Environments A, B both in the HIGH mode and the LOW mode.

[0172] Thereafter, the current control section 3121 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light in the LOW mode (S3012). The control of the current control section 3121 in Environment C after step S3013 differs from the above one. After step S3012, even if the ice making operation by the ice making operation control section 3110 is started and the water supply valve Vs is opened and supplying of water to the water tank 3041 is started, the ultraviolet light irradiation in the LOW mode is continued. If the supplying of water to the water tank 3041 is finished and the water supply valve Vs is closed from the open state (Yes at S3013), the current control section 3121 switches the target current value Ia to a relatively high value of the HIGH mode (S3014). The water remaining in the water tank 3041 stays there and bacteria is likely to grow in the water; however, the ultraviolet light irradiation device 3050 irradiates ultraviolet light to the water in the HIGH mode. This suppresses the bacteria growth.

[0173] Thereafter, if the water supply valve Vs is opened again and supplying of water to the water tank 3041 is started (Yes at S3015), the water is less likely to stay in the water tank 3041. Therefore, the current control section 3121 switches the target current value Ia to the relatively low value of the LOW mode (S3016). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 and ultraviolet light of an amount that is sufficient to keep a UV sterilization condition is irradiated to the water stored in the water tank 3041. Therefore, the ultraviolet light irradiation device 3050 (the light source) can obtain a longest life span with maintaining the UV sterilization condition.

[0174] As previously described, the ice making machine 3001 according to the sixth embodiment includes the ice making section 3005, the ice storing section 3030, and the water supply and discharge mechanism 3040.

5 The ice making section 3005 freezes ice making water and makes ice. The ice storing section 3030 stores ice made by the ice making section 3005. The water supply and discharge mechanism 3040 at least supplies ice making water to and discharges ice making water from the ice making section 3005. The ice making machine 10 3001 further includes the ultraviolet light irradiation device 3050 and the current control section 3121 (one example of the control device 3100). The ultraviolet light irradiation device 3050 irradiates ultraviolet light to the water tank 3041 (the water supply and discharge mechanism 3040) to perform sterilization. The current control section 3121 controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light at least while the ice making operation is being performed and controls the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 according to the driving condition of the ice making section 3005. According to such a configuration, ultraviolet light is irradiated at least while the ice making operation is being performed (including stand- 25 by time). Therefore, the UV sterilization can be performed for ice making water and the UV sterilization can be maintained from the beginning to the end of the ice making operation. Since the amount of ultraviolet light irradiated by the ultraviolet light irradiation device can be increased or decreased as necessary, the life span of the ultraviolet light irradiation device is not reduced unnecessarily and can be kept long and it is economical. This reduces necessity of maintenance.

[0175] The current control section 3121 is configured to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 when the water supply valve Vs is open. The current control section 3121 is configured to decrease the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 when the water supply valve Vs is closed. According to such a configuration, when the UV sterilization is required to be performed for the water to be supplied to the water tank 3041, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 can be appropriately controlled. The current control section 3121 is configured to keep controlling the ultraviolet light irradiation device 3050 to irradiate a small amount of ultraviolet light. When the water supply valve Vs is closed from an open state, the current control section 3121 is configured to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 while the water supply valve Vs is in a closed state. According to such a configuration, the amount of ultraviolet light to be irradiated by the ultraviolet light irradiation device can be appropriately controlled when water to be supplied to the water tank is sufficiently sterilized and the UV sterilization needs to be performed for the water that stays inside the water tank.

[0176] One of the above control processes that is appropriate for the installation environment of the ice making machine 3001 is performed. The current control section 3121 is configured to decrease and increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 according to the installation environment of the ice making machine 3001. According to such a configuration, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 can be appropriately controlled with considering the environment where the ice making machine 3001 is to be installed. The current control section 3121 is configured to decrease and increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 by controlling a current to be supplied to the ultraviolet light irradiation device 3050 with PWM control. According to such a configuration, the current supplied to the ultraviolet light irradiation device 3050 can be appropriately controlled with high-speed switching without changing a voltage. With LEDs being used for the light source of the ultraviolet light irradiation device 3050, the amount of ultraviolet light to be irradiated can be preferably controlled without changing the light emission wavelength of the LEDs.

<<Seventh Embodiment>>

[0177] An ice making machine 3201 according to a seventh embodiment will be described with reference to FIGS. 32 and 33. As illustrated in FIG. 32, the ice making machine 3201 includes an ultraviolet light irradiation device 3250 on the cover 3033 of the ice storing section 3030 in addition to the ultraviolet light irradiation device 3050 mounted on the cover 3043 of the water tank 3041. The ultraviolet light irradiation device 3250 has a configuration similar to that of the ultraviolet light irradiation device 3050 of the sixth embodiment and is electrically connected to the control device 3100. An ice amount sensor 3235 of a disk-like shape includes a hole 3235B at a position opposite the ultraviolet light irradiation device 3250 such that the ice amount sensor 3235 can move in the upper-bottom direction without contacting the ultraviolet light irradiation device 3250. The ice making section 3005, the ice storing section 3030, the water supply and discharge mechanism 3040, and other components have configurations same as those of the components included in the ice making machine 3001 according to the sixth embodiment and provided with the same symbols as those of the sixth embodiment and will not be described (same in the components of an eight embodiment and subsequent embodiments).

[0178] As illustrated in FIG. 28, the ultraviolet light irradiation control section 3120 further includes the current control section 3221 and the electronic circuit section 3122. The electronic circuit section 3122 is mounted on a board and disposed adjacent to the ultraviolet light irradiation device 3250. The electronic circuit section 3122 has a configuration and an operation same as those of

the sixth embodiment. The information related to the target current values I_a that is outputted to the PWM control circuit 3122B by the current control section 3221 and the output timing differ from the information and the output timing operated by the current control section 3121 of the sixth embodiment (same in the eight embodiment and subsequent embodiments).

[0179] The current control section 3221 outputs to the PWM control circuit 3122B information related to the target current value I_a that is to be supplied to the ultraviolet light irradiation device 3250 according to an agitation state of the ice in the ice storing section 3030 of the ice making machine 3201. Specifically, when the ice stays stationary inside the stocker 3031, the ultraviolet light irradiation device 3250 irradiates ultraviolet light only to surfaces of ice pieces facing the ultraviolet light irradiation device 3250. Therefore, the ice pieces that are disposed on an upper surface side can be sterilized with ultraviolet light irradiation with a relatively small amount. However, when the agitator 3036 is driven and the ice pieces stored in the stocker 3031 are agitated, the ice pieces and surfaces of the ice pieces that are exposed to the ultraviolet light irradiation device 3250 are changed. Therefore, a relatively great amount of ultraviolet light is preferably irradiated to the ice pieces to perform UV sterilization.

[0180] Therefore, when the driving section 3027 drives the agitator 3036 during the ice making operation (including the standby state) of the ice making machine 3201, the current control section 3221 sets a relatively high value as a target current value I_a to be instructed to the PWM control circuit 3122B. Thus, the current control section 3221 controls the ultraviolet light irradiation device 3250 in the HIGH mode to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250. When the agitator 3036 is not driven and the ice pieces stored in the stocker 3031 stays stationary inside the stocker 3031 during the ice making operation (including the standby state) of the ice making machine 3201, the current control section 3221 sets a relatively low value as a target current value I_a to be instructed to the PWM control circuit 3122B. Thus, the current control section 3221 controls the ultraviolet light irradiation device 3250 in the LOW mode to decrease the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250.

[0181] The target current values I_a of the HIGH mode and the LOW mode according to the state of ice pieces (with or without agitation) in the stocker 3031 may vary depending on the size of the stocker 3031 of the ice making machine 3201, the agitation state of the ice pieces (shapes of the ice pieces and a shape of the agitator), types of the light sources and the number of light sources included in the ultraviolet light irradiation device 3250. Therefore, the target current values I_a of the HIGH mode and the LOW mode may not be determined to be fixed values but may be determined as appropriate with reference to the configurations of the ice making machine

3201 and the ultraviolet light irradiation device 3250. The target current values Ia in the HIGH mode and the LOW mode can be included in a reference table and previously stored in the memory section 3000M. The current control section 3221 can set the target current value Ia according to the configuration of the ice making machine 3201 with referring to the reference table in the memory section 3000M.

<Control Process 2>

[0182] An example of a process of controlling the ultraviolet light irradiation device 3250 performed by the current control section 3221 will be described with reference to FIG. 33.

[0183] If the switch SW of the ice making machine 3201 turns on and control by the control device 3100 is started, the current control section 3221 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3250 to irradiate ultraviolet light (S3021). At this time, the target current value Ia is a relatively low value of the LOW mode and the amount of ultraviolet light that is irradiated by the ultraviolet light irradiation device 3250 is relatively suppressed but is appropriate for sterilizing the inside of the stocker 3031.

[0184] After step S3021, if the ice making operation control section 3110 starts the ice making operation and the ice making section is cooled by the freezing unit 3010 to the ice making temperature and the ice making unit 3020 is driven, the produced ice is transferred to the stocker 3031 by the rotation of the auger 3022. In the ice making machine 3201, the agitator 3036 is rotated according to the rotation of the auger 3022 performed by the driving section 3027 (Yes at S3022). Therefore, the ice pieces transferred to the stocker 3031 are agitated by the agitator 3036 during the ice making operation (while the auger 3022 is rotated). The current control section 3221 switches the target current value Ia to a relatively high value of the HIGH mode (S3023). This increases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250. Therefore, a sufficient amount of ultraviolet light can be irradiated to the ice pieces that are transferred to the stocker 3031 and agitated in the stocker 3031 to perform the UV sterilization. If the ice making operation is not performed (No at S3022), the ultraviolet light irradiation in the LOW mode is continued.

[0185] If it is detected by the ice amount sensor 3035 that the stocker 3031 is full and filled with ice during the ultraviolet light irradiation in the HIGH mode, the ice making unit 3020 is stopped with the freezing unit 3010 being driven. In other words, the rotation of the agitator 3036 is stopped with the freezing unit 3010 being driven (Yes at S3024). The current control section 3221 switches the target current value Ia to a relatively low value of the LOW mode (S3025). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250 and ultraviolet light of an amount that is sufficient

to keep a UV sterilization condition is irradiated to the ice that stays stationary in the stocker 3031. Therefore, the ultraviolet light irradiation device 3250 (the light source) can obtain a longest life span with maintaining the UV sterilization condition.

[0186] After step S3025, the process returns to step S3022 and switching control between the HIGH mode and the LOW mode (steps S3022 to S3025) will be performed repeatedly in response to the driving of the agitator 3036 inside the stocker 3031.

[0187] According to the above configuration, the ice storing section 3030 includes the agitator 3036 (an agitating member) agitating the ice pieces and the ultraviolet light irradiation device 3250 irradiating ultraviolet light to the ice pieces. The amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250 is increased or decreased depending on with or without agitation of the ice pieces by the agitator 3036. Accordingly, the UV sterilization can be performed to the stocker 3031 and the ice pieces in the stocker 3031. The amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250 is increased when the agitator 3036 is driven to agitate the ice pieces. The amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250 is decreased when the agitator 3036 stops. Thus, the ice pieces can be sterilized with ultraviolet light effectively.

<<Eighth Embodiment>>

[0188] An ice making machine 3301 according to an eighth embodiment will be described with reference to FIGS. 34 and 35. As illustrated in FIG. 34, the ice making machine 3301 differs from the ice making machine 3001 according to the sixth embodiment in a configuration of the water supply and discharge mechanism 3040. A liquid transfer pump Pm is disposed on the first water discharge cavity D1 that is connected to the outlet port of the cylinder 3021. The liquid transfer pump Pm is disposed on a downstream side of and close to the outlet port. The first water discharge cavity D1 is branched into a returning cavity D11 and a branched discharge cavity D12 on a downstream side of the liquid transfer pump Pm. The returning cavity D11 is connected to a circulation hole in the cover 3043 of the water tank 3041 and continuous to the water tank 3041. The branched discharge cavity D12 is connected to the second discharge cavity D2 via the water discharge valve Vd. By opening the water discharge valve Vd, the water that is inside the first water discharge cavity D1 flows to the second water discharge cavity D2 via the branched discharge cavity D12. By closing the water discharge valve Vd, the first water discharge cavity D1 is communicated only with the returning cavity D11. By driving the liquid transfer pump Pm with the water discharge valve Vd being closed, the water being inside the cylinder 3021 can be transferred to the water tank 3041. This provides a circulation cavity (loop cavity) connecting the water tank 3041, the second water supply cavity S2, the cylinder 3021, the first water

discharge cavity D1, the returning cavity D11, and the water tank 3041. The ultraviolet light irradiation device 3350 is disposed on the second water supply cavity S2. The ultraviolet light irradiation device 3350 has a configuration similar to that of the ultraviolet light irradiation device 3050 of the sixth embodiment and is electrically connected to the control device 3100.

[0189] In the control device 3100 of this embodiment, the ice making operation control section 3110 controls each of the components of the ice making machine 3301 to perform a following ice making operation. As illustrated in FIG. 28, the ultraviolet light irradiation control section 3120 further includes a current control section 3321 and an electronic circuit section 3122. The electronic circuit section 3122 is mounted on a board and disposed adjacent to the ultraviolet light irradiation device 3350.

[0190] Similar to the ice making operation control section 3110 of the sixth embodiment, the ice making operation control section 3110 drives the freezing unit 3010 to cool the ice making portion of the cylinder 3021 to the predetermined ice making temperature. Thereafter, the ice making operation control section 3110 drives the ice making unit 3020 and the water supply and discharge mechanism 3040 to make ice with checking whether the amount of ice in the stocker 3031 is full, that is, whether the amount of ice in the stocker reaches an ice making limit amount with the ice amount sensor 3035. If the ice amount sensor 3035 detects that the stocker 3031 is full, the ice making operation becomes on standby. Then, the ice is used, and if the ice amount sensor 3035 detects that the amount of ice stored in the stocker 3031 reaches a predetermined operation restart level, the ice making operation is restarted.

[0191] While the above ice making operation is performed, the ice making operation control section 3110 continues the water level control operation. In the water level control operation, the ice making operation control section 3110 opens the water supply valve Vs if the water level in the water tank 3041 is lowered to the predetermined ice making lowest water level, and the ice making operation control section 3110 closes the water supply valve Vs if the water level increases to the ice making highest water level. The ice making operation control section 3110 is configured to drive the liquid transfer pump Pm for a certain time period at a predetermined time interval to circulate the water inside the circulation cavity when the stocker 3031 is full and the ice making operation is in a standby state (in other words, the freezing unit 3010 is working but the driving section 3027 stops). Thus, the water in the circulation cavity is less likely to stay stationary.

[0192] In response to the driving of the liquid transfer pump Pm of the ice making machine 3301, the current control section 3321 outputs information related to the target current value Ia that is to be supplied to the ultraviolet light irradiation device 3350 to the PWM control circuit 3122B. In other words, while the ice making machine 3301 circulates the water in the circulation cavity,

the current control section 3321 determines that the circulating ice making water has high necessity of UV sterilization and controls to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350. For example, when the ice making machine 3301 performs the ice making operation and the freezing unit 3010 and the driving section 3027 are driven but the liquid transfer pump Pm stops, a flowing speed of the ice making water passing the ultraviolet light irradiation area is relatively slow. Therefore, the target current value Ia to be instructed to the PWM control circuit 3122B is set to a relatively small value and the ultraviolet light irradiation device 3350 is controlled in the LOW mode. Accordingly, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350 is relatively decreased. When the ice making machine 3301 is on standby and waiting for starting to make ice and the current control section 3321 stops the driving section 3027 with driving the freezing unit 3010 and drives the liquid transfer pump Pm, the flowing speed of the ice making water passing the ultraviolet light irradiation area is fast. Therefore, the target current value Ia to be instructed to the PWM control circuit 3122B is set to a relatively great value and the ultraviolet light irradiation device 3350 is controlled in the HIGH mode. Accordingly, the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350 is increased.

[0193] The target current values Ia in the HIGH mode and the LOW mode according to the circulation of water inside the circulation cavity may vary depending on the amount of water flowing inside the circulation cavity per unit time, types of the light sources and the number of light sources included in the ultraviolet light irradiation device 3350. Therefore, the target current values Ia in the HIGH mode and the LOW mode may not be specified but may be determined as appropriate with reference to the configurations of the ice making machine 3301 and the ultraviolet light irradiation device 3350. The target current values Ia in the HIGH mode and the LOW mode can be included in a reference table and previously stored in the memory section M. The current control section 3321 can set the target current value Ia according to the configuration of the ice making machine 3301 with referring to the reference table in the memory section 3000M.

<Control Process 3>

[0194] An example of a process of controlling the ultraviolet light irradiation device 3350 performed by the current control section 3321 will be described with reference to FIG. 35.

[0195] If the switch SW of the ice making machine 3301 turns on and control by the control device 3100 is started, with reference to the reference table stored in the memory section 3000M, the current control section 3321 sets the target current values Ia in the HIGH mode and the LOW mode corresponding to the installation environment of the ice making machine 3301 based on the installation

environment of the ice making machine 3001 that has been previously input by a user (S3031). Thereafter, the current control section 3321 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light (S3032). At this time, the target current value Ia is a relatively low value of the LOW mode and the amount of ultraviolet light that is irradiated by the ultraviolet light irradiation device 3350 is relatively suppressed but is appropriate for sterilizing the second water supply cavity S2 and water flowing inside the second water supply cavity S2.

[0196] After step S3032, the ice making operation control section 3110 starts the ice making operation. The ice making operation control section 3110 controls the freezing unit 3010 to cool the ice making portion to the predetermined ice making temperature and drives the ice making unit 3020. The produced ice is transferred to the stocker 3031. If the ice amount sensor 3035 detects that the stocker 3031 is filled with ice and full, the driving of the driving section 3027 is stopped and the liquid transfer pump Pm is driven for a certain time period at a predetermined time interval to circulate the water inside the circulation cavity. If the liquid transfer pump Pm is driven (Yes at S3033), the current control section 3221 switches the target current value Ia to a relatively high value of the HIGH mode (S3034). This increases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3250 and a sufficient amount of ultraviolet light can be irradiated to the water circulating inside the circulation cavity. If the liquid transfer pump Pm is not driven (No at S3033), the UV irradiation in the LOW mode will be continued.

[0197] If the liquid transfer pump Pm is stopped during the ultraviolet light irradiation in the HIGH mode (YES at S3035), the current control section 3321 switches the target current value Ia to a relatively low value of the LOW mode (S3036). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350 and an appropriate amount of ultraviolet light can be irradiated to the water staying in the circulation cavity. After step S3036, the process returns to step S3033 and switching control between the HIGH mode and the LOW mode (steps S3033 to S3036) will be performed repeatedly in response to the driving of the liquid transfer pump Pm.

[0198] According to the above configuration, the water supply and discharge mechanism 3040 includes the water tank 3041, the second water supply cavity S2 (an ice making water supply cavity), the first water discharge cavity D1 and the returning cavity D11 (the circulation cavity), and the liquid transfer pump Pm. The first water discharge cavity D1 and the returning cavity D11 are different cavities from the second water supply cavity S2 and connect the water tank 3041 and the cylinder 3021 (the ice making section 3005). The first water discharge cavity D1 and the returning cavity D11 are for transferring water inside the cylinder 3021 back to the water tank

3041. The liquid transfer pump Pm is disposed on the first water discharge cavity D1 and for transferring the water inside the first water discharge cavity D1 to the water tank 3041. In the water supply and discharge mechanism 3040, the water tank 3041, the second water supply cavity S2, the first water discharge cavity D1, and the returning cavity D11 are configured as the circulation cavity. The ultraviolet light irradiation device 3350 is on the circulation cavity. The current control section 3321 is configured to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350 when the liquid transfer pump Pm is driven and to decrease the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3350 when the liquid transfer pump Pm is not driven. With such a configuration, when the water stays in the irradiation area of the ultraviolet light irradiation device 3350 that is disposed on the circulation cavity or the flowing speed of the water is relatively slow, the amount of ultraviolet light to be irradiated is relatively decreased such that the ultraviolet light irradiation device 3350 has a longest life span. When a large amount of water passes through the irradiation area, a sufficient amount of ultraviolet light is irradiated and the UV sterilization can be effectively performed to circulating water.

<<Ninth Embodiment>>

[0199] An ice making machine 3401 according to a ninth embodiment will be described with reference to FIG. 36. The ice making section 3005, the ice storing section 3030, and the water supply and discharge mechanism 3040 of the ice making machine 3401 have configurations similar to those of the ice making machine 3001 of the sixth embodiment (refer to FIG. 26). In the ice making machine 3401 of this embodiment, the information related to the target current values Ia that are outputted to the PWM control circuit 3122B by a current control section 3421 (refer to FIG. 28) differs from the information related to the target current value outputted by the current control section 3121 of the sixth embodiment.

[0200] The current control section 3121 of the ice making machine 3001 according to the sixth embodiment switches a current supplied to an ultraviolet light irradiation device 4050 between the HIGH mode and the LOW mode according to the opening and closing of the water supply valve Vs. Thus, the information related to the target current values Ia to be outputted to the PWM control circuit 3122B is varied between the HIGH mode and the LOW mode. The ultraviolet light irradiation device 3050 is deteriorated due to the flowing of current. Therefore, the ultraviolet light irradiation device 3050 is generally characterized in that the amount of ultraviolet light emitted by the ultraviolet light sources is proportional to a current but the amount of emitted ultraviolet light decreases exponentially under a certain current as the time passes.

The current control section 3421 of this embodiment cal-

culates accumulated irradiation time T_t calculated from the start of using the ultraviolet light irradiation device 3050 at predetermined time intervals when the ultraviolet light irradiation device 3050 included in the water tank 3041 irradiates ultraviolet light to the water inside the water tank 3041. The current control section 3421 increases the target current value I_a to be outputted to the PWM control circuit 3122B corresponding to the increase of the accumulated irradiation time T_t so as to keep the amount of ultraviolet light that is actually irradiated by the ultraviolet light irradiation device 3050 even though the accumulated irradiation time T_t increases. The current control section 3421 informs a user that the ultraviolet light irradiation device 3050 reaches the end of the life span when the accumulated irradiation time T_t of the ultraviolet light irradiation device 3050 reaches the end of the life span of the device 3050. In calculation of the accumulated irradiation time T_t , for instance, the accumulated irradiation time T_t may be obtained by adding time to next recalculation every time the target current value I_a is recalculated. The accumulated irradiation time T_t at the time of recalculation is stored in the memory section 3000M.

[0201] The ultraviolet light irradiation device 3050 may reach the end of a life span when the lumen (illuminance) maintenance factor becomes 70%, for instance. The ultraviolet light irradiation device 3050 may have accumulated irradiation time of 10,000 hours as the irradiation time with 70% of the lumen (illuminance) maintenance factor. In such an ultraviolet light irradiation device 3050, the current control section 3421 sets 70% of the rated current as the target current value I_a at the time of the first use ($T_t=0$) of the ultraviolet light irradiation device 3050. The current control section 3421 gradually increases the target current value I_a according to the accumulated irradiation time such that the target current value I_a at the time of the accumulated irradiation time being 10,000 hours is 100% of the rated current.

For instance, if the light sources of the ultraviolet light irradiation device 3050 are UV-LEDs, the ultraviolet light irradiation amount Q_x with a predefined current value I_x is represented by the following formula (1) as a function of the accumulated irradiation time T_x . In the following formula, C represents a constant of proportionality defined by the light source (UV-LED) and τ represents a time constant in the lowering of illuminance.

$$Q_x = I_x \times C \times \exp(-T_x/\tau) \quad (1)$$

[0202] Therefore, for instance, the current value I_x of the ultraviolet light irradiation device 3050 for maintaining for the accumulated irradiation time T_x the amount of ultraviolet light that is emitted by the UV-LEDs with a current I_0 at the initial state T_0 is represented by the following formula (2).

$$I_x = I_0 \times \exp(T_x/\tau) \quad (2)$$

Similarly, with the longest irradiation time of the UV-LED light source being defined as T_{life} , the current I_{life} of the ultraviolet light irradiation device 3050 with maintaining the amount of ultraviolet light that is emitted by the UV-LED with the current I_0 at the initial state T_0 is represented by the following formula (3).

$$I_{life} = I_0 \times \exp(T_{life}/\tau) \quad (3)$$

From the formula (3), a light source is selected such that the current I_{life} , which enables the light source to emit ultraviolet light of a desired irradiation amount Q_x at the final period of the life span of the light source, is equal to or smaller than the highest rated current of the light source, and the current control section 3421 sets the current value I_x , with which the ultraviolet light of the predefined irradiation amount Q_x is irradiated according to the accumulated irradiation time T_x , as the target current value I_a . With respect to the ultraviolet light irradiation device 3050, the time constant τ in the lowering of illuminance and the initial value of the target current value I_a (70% of the rated current) can be previously stored in the memory section M.

<Control Process 4>

[0203] An example of a process of controlling the ultraviolet light irradiation device 3050 performed by the current control section 3421 will be described with reference to FIG. 36.

[0204] If the switch SW of the ice making machine 3401 turns on and control by the control device 3100 is started, with reference to the reference table stored in the memory section 3000M, the current control section 3421 sets an initial value of the target current values I_a corresponding to the ultraviolet light irradiation device 3050 to be used (S3041). Thereafter, the current control section 3421 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light (S3042).

[0205] After step S3042, the ice making operation control section 3110 starts the ice making operation. The current control section 3421 calculates accumulated irradiation time T_x of the ultraviolet light irradiation device 3050 at predetermined time intervals and stores the calculated accumulated irradiation time T_x in the memory section 3000N (S3043). The current control section 3421 calculates a current value I_x that is necessary for maintaining the ultraviolet light irradiation amount Q_x during the accumulated irradiation time T_x and resets the calculated current value I_x as the target current value I_a and outputs the calculated current value I_x to the PWM control circuit 3122B (S3044). Such resetting of the target current value I_a is performed repeatedly until it is determined

that the accumulated irradiation time Tx reaches the end of the life span of the ultraviolet light irradiation device 3050 (time with 70% of the lumen (illuminance) maintenance factor) (Yes at S3047). However, during the re-setting, the ice making operation control section 3110 may finish the ice making operation or the switch SW may be turned off and the ultraviolet light irradiation device 3050 may be off (Yes at S3045) and no current may be supplied. In such a case, the calculation of the accumulated irradiation time Tx of the ultraviolet light irradiation device 3050 is stopped temporally, and if the ultraviolet light irradiation device 3050 is turned on again (Yes at S3046), the process returns to step S3043 and the calculation of the accumulated irradiation time Tx of the ultraviolet light irradiation device 3050 is restarted.

[0206] If the accumulated irradiation time Tx reaches the end of the life span of the ultraviolet light irradiation device 3050 (Yes at S3047), the current control section 3421 informs a user that the ultraviolet light irradiation device 3050 reaches the end of the life span with displaying on the display section 3152 (S3048). According to the above configuration, the current control section 3421 includes a timer T that measures the irradiation time of the ultraviolet light emitted by the ultraviolet light irradiation device 3050. The current control section 3421 is configured to increase the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 according to the accumulated irradiation time (the irradiation time). Accordingly, if the ultraviolet light irradiation device 3050 becomes close to the end of the life span, the current supplied to the ultraviolet light irradiation device 3050 can be increased to compensate for the decrease in the emission of light due to the end of the life span. As a result, although the ultraviolet light irradiation device 3050 is deteriorated over time, a necessary amount of ultraviolet light can be irradiated appropriately even if the ultraviolet light irradiation device 3050 (the light source) is close to the end of the life span. If the ultraviolet light irradiation device 3050 reaches the end of the life span, it can be informed a user that the device is at the end of the life span and it is less likely to be happened that the UV sterilization by the ultraviolet light irradiation device 3050 is not performed.

<<Tenth Embodiment>>

[0207] An ice making machine 3501 according to a tenth embodiment will be described with reference to FIG. 37. The operation of the ice making machine 3501 (refer to FIG. 26) is partially modified from the operation of the current control section 3421 (refer to FIG. 28) of the ice making machine 3401 of the ninth embodiment. The current control section 3421 of the ninth embodiment measures the accumulated irradiation time Tx of the ultraviolet light irradiation device 3050 with the timer 3000T and determines whether the accumulated irradiation time Tx reaches the end of the life span of the ultraviolet light irradiation device 3050 at step S3047. In the tenth em-

bodiment, a current control section 3521 (refer to FIG. 28) determines whether the accumulated irradiation time Tx is equal to a prenotice time that is a predetermined time before the end of the life span of the ultraviolet light irradiation device 3050 (S3051). If it is determined that the accumulated irradiation time Tx is equal to the prenotice time, the current control section 3521 controls the display section 3152 to display a predefined error message to inform a user that the ultraviolet light irradiation device 3050 needs to be replaced (S3052). Thereafter, until the accumulated irradiation time Tx reaches the end of the life span, the current control section 3521 confirms whether the ultraviolet light irradiation device 3050 is replaced with another one at predetermined time intervals (S3053). If the ultraviolet light irradiation device 3050 is replaced with another one (Yes at S3053), the current control section 3521 resets the accumulated irradiation time Tx to zero and the process returns to step S3041 (refer to FIG. 33). The current control section 3521 sets an initial value of the target current value Ia for the new ultraviolet light irradiation device 3050 with reference to the reference table stored in the memory section 3000M (S3041). On the other hand, if the accumulated irradiation time Tx reaches the end of the life span without the ultraviolet light irradiation device 3050 being replaced another one (NO at S3053), the current control section 3521 determines that the ice making machine 3501 cannot be operated with good sanitation and stops the operation of the ice making machine 3501.

[0208] According to the above configuration, the current control section 3521 includes the timer 3000T that measures the irradiation time of the ultraviolet light emitted by the ultraviolet light irradiation device 3050. The current control section 3521 is configured to inform that the ultraviolet light irradiation device 3050 is close to the end of the life span predetermined time before the end of the life span of the ultraviolet light irradiation device 3050. Accordingly, a user is informed of necessity of an appropriate performance such as replacement before the ultraviolet light irradiation device 3050 reaches the end of the life span. As a result, the ice making machine 3501 can be operated without causing an error in the ultraviolet light irradiation device 3050 because of the life span and with keeping good sanitation. Furthermore, according to the above configuration, the current control section 3521 is configured to stop the operation of the ice making machine 3501 if the ultraviolet light irradiation device 3050 does not recover its life span during a predetermined time period after informing that the ultraviolet light irradiation device 3050 is close to the end of the life span. Accordingly, a user is surely informed of the replacement of the ultraviolet light irradiation device 3050. Furthermore, the ice making machine 3501 is less likely to be operated by a user with an environment in which good sanitation cannot be ensured.

<<Eleventh Embodiment>>

[0209] An ice making machine 3601 according to an eleventh embodiment will be described with reference to FIG. 38. The ice making machine 3601 includes the ice making section 3005, the ice storing section 3030, and the water supply and discharge mechanism 3040 that have same configurations as those of the ice making machine 3001 of the sixth embodiment (refer to FIG. 26). In the ice making machine 3601 of this embodiment, the information related to the target current values I_a that is outputted to the PWM control circuit 3122B by a current control section 3621 (refer to FIG. 28) and the output timing differ from the information and the output timing operated by the current control section 3121 of the sixth embodiment.

[0210] The current control section 3121 of the sixth embodiment switches the operation mode between the HIGH mode and the LOW mode according to the closing and opening of the water supply valve V_s when the freezing unit 3010 is driven and the installation environment of the ice making machine 3001 is Environment A, B. Thus, the information related to the target current values I_a to be outputted to the PWM control circuit 3122B is varied. In other words, while water is being supplied to the water tank 3041, the ultraviolet light irradiation device 3050 emits ultraviolet light of a substantially constant amount corresponding to the HIGH mode. However, in the ultraviolet light irradiation device 3050, the irradiation intensity of ultraviolet light per a unit area is inversely proportional to the second power of a distance from the ultraviolet light source and therefore, the UV sterilization effects are exponentially decreased as the distance between the ultraviolet light irradiation device and a target object of the UV sterilization increases. The current control section 3621 of this embodiment performs following operations when the ultraviolet light irradiation device 3050 included in the water tank 3041 irradiates ultraviolet light to the water, which is being supplied to the water tank 3041, in the HIGH mode. The current control section 3621 is configured to control the ultraviolet light irradiation device 3050 to irradiate a greater amount of ultraviolet light as the distance between the light source of the ultraviolet light irradiation device 3050 and the surface of the water in the water tank 3041 increases and to vary the information related to the target current value I_a to be outputted to the PWM control circuit 3122B such that the amount of ultraviolet light decreases as the distance decreases. In other words, the current control section 3621 varies the information related to the target current values I_a to be outputted to the PWM control circuit 3122B such that a greater amount of ultraviolet light is emitted as the water level in the water tank 3041 detected by the water amount sensor 3048 is lower.

[0211] The relation of the target current value I_a and the water level in the water tank 3041 depends on the size and volume of the water tank 341, the supply speed of water that flows when the water supply valve V_s is

opened, the type of the light sources and the number of the light sources included in the ultraviolet light irradiation device 3050. Therefore, the relation of the water level in the water tank 3041 and the target current values I_a is previously determined for each ice making machine 3601 and can be included in the reference table and previously stored in the memory section M. With reference to the reference table in the memory section 3000M, the current control section 3621 outputs the information related to the target current value I_a that is suitable to the water level to the PWM control circuit 3122B every time the water level in the water tank is varied. For example, the current control section 3621 defines three water levels in the water tank 3041 and changes the target current value I_a corresponding to the water level with three steps. More preferably, the current control section 3621 can control the target current value I_a corresponding to the water level every time the water amount sensor 3048 detects the water level in the water tank 3041 at the pre-determined intervals.

<Control Process 6>

[0212] One example of a control process of the ultraviolet light irradiation device 3050 performed by the current control section 3621 will be described with reference to FIG. 38. The following is an example of the control process in Environment A, B.

[0213] If the switch SW of the ice making machine 3601 turns on and control by the control device 3100 is started, with reference to the reference table stored in the memory section M, the current control section 3621 sets the relation of the target current value I_a in the LOW mode and the target current value I_a of the HIGH mode corresponding to the installation environment of the ice making machine 3001 based on the installation environment of the ice making machine 3001 that is previously inputted by a user (S3061). The target current value I_a in the HIGH mode is varied according to the change of the water level in the water tank 3041. The target current value I_a corresponding to the predetermined water level at the time of the control in the HIGH mode may be set corresponding to the current water level with reference to the reference table in step S3064, which will be described later.

[0214] Thereafter, the current control section 3621 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3050 to irradiate ultraviolet light (S3062). At this time, the target current value I_a is a relatively low value of the LOW mode and the amount of ultraviolet light that is irradiated by the ultraviolet light irradiation device 3350 is relatively suppressed but is appropriate for sterilizing the water tank 3041.

[0215] After step S3062, if the ice making operation control section 3110 starts the ice making operation and the water supply valve V_s is opened with the freezing unit 3010 being driven (Yes at S3063), the current control section 3621 switches the target current value I_a to a

relatively high value of the HIGH mode and varies the target current value Ia corresponding to the water level in the water tank 3041 that is detected by the water amount sensor 3048 at predetermined time intervals (S3064). The target current value Ia is varied such that a relatively large amount of ultraviolet light is emitted by the ultraviolet light irradiation device 3050 when the distance between the light source of the ultraviolet light irradiation device 3050 and the surface of the water in the water tank 3041 is large and a relatively smaller amount of ultraviolet light is emitted as the distance decreases. Thus, the ultraviolet light irradiation device 3050 can be controlled to obtain desired UV sterilization effects with considering the distance between the light source of the ultraviolet light irradiation device 3050 and the surface of the water in the water tank 3041. If the ice making operation is not started (No at S3063), the ultraviolet light irradiation in the LOW mode will be continued.

[0216] The ultraviolet light irradiation in the HIGH mode corresponding to the water level is continued until the water in the water tank 3041 reaches the ice making highest water level. If the water in the water tank 3041 reaches the ice making highest water level, the water supply valve Vs is opened with the freezing unit 3010 and the ice making unit being driven (Yes at S3065). The current control section 3621 switches the target current value Ia to the relatively low value of the LOW mode (S3066). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3050 and ultraviolet light is irradiated to the water stored in the water tank 3041 with a sufficient amount for keeping a UV sterilization condition. Therefore, the ultraviolet light irradiation device 3050 (the light source) can obtain a longest life span with maintaining the UV sterilization condition. After step S3066, the process returns to step S3063 again. Responding to opening and closing of the water supply valve Vs according to the water level control of water in the water tank 3041 during the ice making operation and the water level in the water tank 3041, the switching control between the HIGH mode and the LOW mode (steps S3063 to S3066) will be performed repeatedly.

[0217] According to the above configuration, when the water level of the water stored in the water tank 3041 that is detected by the water amount sensor 3048 is relatively high, the current control section 3621 is configured to reduce the amount of ultraviolet light emitted by the ultraviolet light irradiation device 3050. When the water level of the water stored in the water tank 3041 that is detected by the water amount sensor 3048 is relatively low, the current control section 3621 is configured to increase the amount of ultraviolet light emitted by the ultraviolet light irradiation device 3050. Accordingly, the irradiation amount of ultraviolet light can be varied according to the distance between the ultraviolet light irradiation device 3050 included in the water tank 3041 and the water (a surface of the water) in the water tank 3041. As a result, the UV sterilization can be effectively performed to the water stored in the water tank without re-

ceiving influence from the distance between ultraviolet light irradiation device 3050 and the surface of the water.

<<Twelfth Embodiment>>

[0218] An ice making machine 3701 according to a twelfth embodiment will be described with reference to FIGS. 39 and 40. In the ice making machine 3701, the freezing unit 3010 and the configurations that are lower than the forming member 3023 of the ice making unit 3020 are same as those included in the ice making machine 3001 of the sixth embodiment. The ice making machine 3701 differs from the ice making machine 3001 of the sixth embodiment in the ice storing section 3030 that is disposed below the ice making unit 3020 and in an ice transfer cavity extending from an upper end of the ice making unit 3020 to the ice storing section 3030. A cutter 3024 is coaxially fixed to the upper end portion of the auger 3022 that projects upward from the forming member 3023 of the ice making unit 3020. With the cutter 3024 being rotated with the auger 3022, the column-shaped ice blocks that are transferred from the forming member 3023 are cut into pieces at predetermined intervals. The ice storing section 3030 includes a stocker 3031 of a rectangular parallelepiped box shape and a cover, which is not illustrated, on a front surface of the stocker 3031. The cover is for closing and opening an ice outlet hole in the front surface of the stocker 3031. A lower end of a circular cylindrical chute 3025B extending in the upper-bottom direction is inserted in and connected to the upper wall of the stocker 3031. A spout 3025A connects the upper end of the ice making unit 3020 and the upper end of the chute 3025B. The spout 3025A is mounted to cover the cutter 3024. The ice pieces cut by the cutter 3024 are transferred horizontally inside the spout 3025A and fall down inside the chute 3025B and are transferred to the stocker 3031. The spout 3025A and the chute 3025B are configured as an ice transfer cavity of the ice making machine 3701. An ultraviolet light irradiation device 3750 is disposed in a middle of the chute 3025B with respect to the upper-bottom direction. The ice amount sensor 3035 is mounted on the upper wall of the stocker 3031. The configurations of the ultraviolet light irradiation device 3750 and the ice amount sensor 3035 are similar to those of the ultraviolet light irradiation device 3050 and the ice amount sensor 3035 of the sixth embodiment. The ultraviolet light irradiation device 3750 and the ice amount sensor 3035 are electrically connected to the control device 3100.

[0219] In the ultraviolet light irradiation control section 3120 of this embodiment, the information related to the target current value Ia that is outputted to the PWM control circuit 3122B by a current control section 3721 (refer to FIG. 28) and the output timing differ from the information and the output timing operated by the current control section 3121 of the sixth embodiment. The current control section 3721 varies the information related to the target current value Ia to be outputted to the PWM control circuit

3122B such that the ultraviolet light irradiation device 3750 emits a relatively large amount of ultraviolet light while the ice, which is made by performing the ice making operation by the ice making machine 3701, is being transferred inside the ice transfer cavity (the HIGH mode control). The current control section 3721 varies the information related to the target current value Ia to be outputted to the PWM control circuit 3122B such that the ultraviolet light irradiation device 3750 emits a relatively small amount of ultraviolet light while the ice, which is made by performing the ice making operation by the ice making machine 3701, is not transferred inside the ice transfer cavity (the LOW mode control). The target current values Ia of the HIGH mode and the LOW mode may vary depending on the amount of ice made per unit time, types of the light sources and the number of light sources included in the ultraviolet light irradiation device 3750. Therefore, the target current values Ia in the HIGH mode and the LOW mode may not be specified but may be determined as appropriate with reference to the configurations of the ice making machine 3701 and the ultraviolet light irradiation device 3750. The target current values Ia of the HIGH mode and the LOW mode can be included in a reference table and previously stored in the memory section M. The current control section 3721 can set the target current value Ia according to the configuration of the ice making machine 3701 with referring to the reference table in the memory section M.

<Control Process 7>

[0220] One example of a control process of the ultraviolet light irradiation device 3750 performed by the current control section 3721 will be described with reference to FIG. 40.

[0221] If the switch SW of the ice making machine 3701 turns on and control by the control device 3100 is started, the current control section 3721 controls the switching element Q3 to turn ON and closes the switch 3123 and controls the ultraviolet light irradiation device 3750 to irradiate ultraviolet light (S3071). At this time, the target current value Ia is a relatively low value of the LOW mode and the amount of ultraviolet light that is irradiated by the ultraviolet light irradiation device 3750 is relatively suppressed but is appropriate for sterilizing the inside of the chute 3025B.

[0222] After step S3071, the ice making operation control section 3110 starts the ice making operation and the ice making section is cooled down to the ice making temperature by the freezing unit 3010 and the ice making unit 3020 is driven. Then, the produced ice is cut into pieces by the cutter 3024 according to the rotation of the auger 3022 and the ice pieces are transferred to the stocker 3031 via the spout 3025A and the chute 3025B. If the driving section 3027 is driven with the freezing unit 3010 being driven, the produced ice pieces move through the chute 3025B and the current control section 3721 switches the target current value Ia to a relatively high

value of the HIGH mode (S3073). This increases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3750. Therefore, a sufficient amount of ultraviolet light can be irradiated to the ice pieces that are transferred inside the chute 3025B and the ice pieces can be sterilized with ultraviolet light. If the ice making operation is not performed (No at S3072), the ultraviolet light irradiation in the LOW mode will be continued.

[0223] If it is detected by the ice amount sensor 3035 that the stocker 3031 is full and filled with ice during the ultraviolet light irradiation in the HIGH mode, the driving of the driving section 3027 is stopped with the freezing unit 3010 being driven (Yes at S3074). The current control section 3721 switches the target current value Ia to a relatively low value of the LOW mode (S3075). This decreases the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3750 and ultraviolet light is irradiated to the chute 3025B with an amount that is sufficient to keep a UV sterilization condition while the ice does not move through the chute 3025B. Therefore, the ultraviolet light irradiation device 3250 (the light source) can obtain a longest life span with maintaining the UV sterilization condition. After step S3075, the process returns to step S3072 and the switching control between the HIGH mode and the LOW mode (steps S3072 to S3075) will be performed repeatedly in response to the driving of the driving section 3027.

[0224] In the above configuration, the ice making section 3005 includes the freezing unit 3010 and the ice making unit 3020, and the ice making section 3050 and the ice making unit 3020 are connected by the ice transfer cavity through which ice made by the ice making unit 3020 is transferred. The ultraviolet light irradiation device 3750 is disposed on the ice transfer cavity (the chute 3025B). When the freezing unit 3010 is driven, the current control section 3721 is configured to increase the amount of ultraviolet light emitted by the ultraviolet light irradiation device 3750. When the freezing unit 3010 is not driven, the current control section 3721 is configured to reduce the amount of ultraviolet light emitted by the ultraviolet light irradiation device 3750. Accordingly, the UV sterilization can be performed to the ice that is being transferred to the ice storing section 3030 after the ice is made. By increasing the amount of ultraviolet light irradiated by the ultraviolet light irradiation device 3750 while the ice making operation being performed and the ice being transferred in the ice transfer cavity, the ice can be sterilized with ultraviolet light effectively.

<<Thirteenth Embodiment>>

[0225] A thirteenth embodiment will be described with reference to FIG. 41. An ultraviolet light irradiation device 3850 of the thirteenth embodiment is disposed at a position as described in any one of the sixth to twelfth embodiments and current supply control is performed. As illustrated in FIG. 17, the ultraviolet light irradiation device 3850 and a visible light irradiation device 3060 are elec-

trically connected in series and configured as an error detection circuit FD1. The error detection circuit FD1 is connected to a point between the terminal a2, which extends from the middle connection point a of phase 1 and the current detection resistance R of the electronic circuit section 3122, and the middle connection point b of phase 2. The visible light irradiation device 3060 is a visible light LED (same in a fourteenth embodiment and subsequent embodiments), for example, and is connected to the terminal a2. The error detection circuit FD1 may additionally include a voltage dividing resistance R0 that is connected in series. The visible light irradiation device 3060 is disposed at a position (for example, on the operation panel 3150, inside the stocker 3031, or a position so as to be seen through holes of the air filter 3004 inside the case 3003) so as to be seen from the outside of the case 3003 (refer to FIG. 25) without taking apart an ice making machine 3801 (refer to FIG. 26) (same in the fourteenth embodiment and subsequent embodiments).

[0226] Generally, ultraviolet light irradiated by the ultraviolet light irradiation device 3850 is invisible to human. Even if the ultraviolet light irradiation device 3850 has a trouble, a user cannot check the trouble in the ultraviolet light irradiation device 3850 by sight. However, with an ultraviolet light irradiation device 3860 being included in the error detection circuit FD1, if disconnection occurs in the ultraviolet light irradiation device 3860, the disconnection can be visibly checked by the visible light irradiation device 3060 that is off. If short-circuit occurs in the ultraviolet light irradiation device 3860, the short-circuit can be visibly checked by the visible light irradiation device 3060 that is lighted quite brightly. Accordingly, a trouble in the ultraviolet light irradiation device 3860 that is invisible to human can be detected by sight with a simple configuration by using visible light.

<<Fourteenth Embodiment>>

[0227] A fourteenth embodiment will be described with reference to FIG. 42. An ultraviolet light irradiation device 3950 of the fourteenth embodiment is disposed at a position as described in any one of the sixth to twelfth embodiments and current supply control is performed. As illustrated in FIG. 42, a coil C1 that is a portion of an a contact relay RL1 and a first resistor R11 that has a relatively low resistance value are electrically connected in series to the ultraviolet light irradiation device 3950 and are configured a first circuit. A contact point X1 that is another portion of the a contact relay RL1 and becomes electrically conductive when a current flows to the coil C1, a second resistor R12 that has a relatively high resistance value, and the visible light irradiation device 3060 are electrically connected in series and are configured as a second circuit. The first circuit and the second circuit are disposed in parallel and configured as an error detection circuit FD2. The coil C1 of the first circuit and the contact point X1 of the second circuit are configured as the a contact relay RL1 and are connected to the ter-

minal a2. The ultraviolet light irradiation device 3950 of the first circuit and the visible light irradiation device 3060 of the second circuit are connected to the terminal b2.

[0228] In the thirteenth embodiment, the ultraviolet light irradiation device 3950 and the visible light irradiation device 3060 are connected in series and configured as the error detection circuit FD1. The UV-LED currently has quite low light emission efficiency compared to that of the visible light LED. Therefore, a relatively high current of about several hundred mA needs to be supplied to the error detection circuit FD1 so as to enable the UV-LED to emit light intensely in the error detection circuit FD1. Accordingly, an expensive element having rated current value needs to be used as the UV-LED. On the other hand, in the error detection circuit FD2 of the fourteenth embodiment, the first circuit and the second circuit, which are arranged in parallel, include the first resistor R11 and the second resistor R12, respectively, as a dividing resistance. With such a configuration, a relatively high current (for example, about 100 mA to 300 mA) can be supplied to the first circuit including the ultraviolet light irradiation device 3950 and a relatively low current (for example about 10 mA to 30 mA) can be supplied to the second circuit including the visible light irradiation device 3060. The first circuit and the second circuit are portions of the a contact relay RL1 that is a normally open contact point. Therefore, in a normal state, when the ultraviolet light irradiation device 3950 turns on, the visible light irradiation device 3060 also turns on. The lighting of the ultraviolet light irradiation device 3950 can be visibly checked with the visible light. If the ultraviolet light irradiation device 3950 is in an abnormal state and turns off, the visible light irradiation device 3060 also turns off. The abnormal state of the ultraviolet light irradiation device 3950 can be visibly checked with no visible light being seen. Accordingly, the lighting state of the ultraviolet light irradiation device 3950 that cannot be visibly checked by human can be checked more surely by checking the lighting state of visible light.

<<Fifteenth Embodiment>>

[0229] A fifteenth embodiment will be described with reference to FIG. 43. An ultraviolet light irradiation device 31050 of the fifteenth embodiment is disposed at a position as described in any one of the sixth to twelfth embodiments and current supply control is performed. A coil C2 that is a portion of a b contact relay RL2 is electrically connected in series to the ultraviolet light irradiation device 31050 and the coil C2 and the ultraviolet light irradiation device 31050 are configured as the first circuit. A contact point X2 that is another portion of the b contact relay RL2 and becomes open when a current flows to the coil C2, and an alarm Bz are electrically connected in series and are configured as a second circuit. The first circuit and the second circuit are disposed in parallel and configured as an error detection circuit FD3. The coil C2 of the first circuit and the contact point X2 of the second

circuit, which are configured as the b contact relay RL2, are connected to the terminal a2. The ultraviolet light irradiation device 31050 of the first circuit and the alarm Bz of the second circuit are connected to the terminal b2. The first circuit may additionally include a voltage dividing resistance R0 that is connected in series between the coil C2 and the ultraviolet light irradiation device 31050.

[0230] When the ultraviolet light irradiation device 31050 is disposed in any one of the ice making section 3005, the ice storing section 3030, and the water supply and discharge mechanism 3040 of an ice making machine 31001 (refer to FIG. 26), the electronic circuit section 3122 or the visible light irradiation device 3060 of the error detection circuit FD3 may not be mounted at a position so as to be visibly seen from the outside of the case 3003 (refer to FIG. 25) of the ice making machine 31001. In the above configuration, the first circuit including the ultraviolet light irradiation device 31050 and the second circuit including the alarm Bz are arranged in series and the first circuit and the second circuit are configured as portions of the b contact relay RL2 that is a normally closed contact point. When a current flows to the ultraviolet light irradiation device 31050 and the ultraviolet light irradiation device 31050 turns on in a normal state, the b contact relay RL2 is opened and no current is supplied to the alarm Bz. On the other hand, no current flows to the ultraviolet light irradiation device 31050 in an abnormal state, the b contact relay RL2 returns to the normally closed state and a current is supplied to the alarm Bz. With the alarm Bz being a buzzer, abnormalities of the ultraviolet light irradiation device can be informed with buzzer sound. Accordingly, with the ice making machine 31001 being installed at a position not to be visibly seen, a user can be informed of abnormalities of the ultraviolet light irradiation device 31050.

<<Sixteenth Embodiment>>

[0231] A sixteenth embodiment will be described with reference to FIGS. 44 and 45. An ultraviolet light irradiation device 31150 of the sixteenth embodiment is disposed at a position as described in any one of the sixth to twelfth embodiments and current supply control is performed. As illustrated in FIG. 44, the ultraviolet light irradiation device 31150 further includes a thermistor Th (one example of a temperature sensor) that measures temperature of the ultraviolet light irradiation device 31150 and is configured as a portion of an error detection circuit FD4. The thermistor Th is electrically connected to the ultraviolet light irradiation control section 3120. Generally, the ultraviolet light irradiation device 31150 is heated by a current that is supplied to the ultraviolet light irradiation device 31150 to emit ultraviolet light. When a predetermined time has passed after the ultraviolet light irradiation control section 3120 starts supplying current to the ultraviolet light irradiation device 31150, the ultraviolet light irradiation control section 3120 of this embodiment determines whether the ultraviolet light irradiation

device 31150 is heated to a presumed temperature that is previously determined. The predetermined time is a presumed time during which it is presumed that the ultraviolet light irradiation device 31150 is heated to some extent. Thus, the ultraviolet light irradiation control section 3120 checks whether the ultraviolet light irradiation device 31150 normally emits light and performs error detection. The error detection circuit FD4 may additionally include a voltage dividing resistance R0 that is connected in series at a position between the terminal a2 and the ultraviolet light irradiation device 31150, for example.

[0232] As illustrated in FIG. 45, if the switch SW of an ice making machine 31101 (refer to FIG. 26) turns on and control by the control device 3100 is started, a current control section 31121 of the ultraviolet light irradiation control section 3120 controls the switching element Q3 to turn ON and closes the switch 3123. A current is supplied to the ultraviolet light irradiation device 31150 and ultraviolet light is emitted by the ultraviolet light irradiation device 31150 (LOW mode) (S3101). At this time, the ultraviolet light irradiation control section 3120 detects initial temperature Tmp0 with the thermistor Th when supplying of current to the ultraviolet light irradiation device 31150 is started (S3102). With the timer 3000T, the ultraviolet light irradiation control section 3120 measures irradiation time from starting of emission of ultraviolet light by the ultraviolet light irradiation device 31150 (S3103). When the predetermine time has passed from the starting of supplying current, the ultraviolet light irradiation control section 3120 detects temperature Temp1 of the ultraviolet light irradiation device 31150 with the thermistor Th. The ultraviolet light irradiation control section 3120 determines whether a temperature increase value from the initial temperature (Tmp1-Tmp0) is equal to or greater than a predetermined threshold value (S3104). If the temperature increase value (Tmp1-Tmp0) of the ultraviolet light irradiation device 31150 is equal to or greater than the predetermined threshold value (Yes at S3104), it is determined that the ultraviolet light irradiation device 31150 operates normally (S3105) and the error detection process is terminated. On the other hand, if the temperature increase value (Tmp1-Tmp0) of the ultraviolet light irradiation device 31150 is less than the predetermined threshold value Tmp-th (No at S3104), it is determined that the ultraviolet light irradiation device 31150 does not operate normally (has a trouble) (S3106). A predetermined error message is displayed on the display section 3152 to inform a user that the ultraviolet light irradiation device 31150 does not operate normally (S3107).

[0233] The ice making machine 31101 having the above configuration includes the thermistor Th (the temperature sensor) that measures temperature of the ultraviolet light irradiation device 31150. If difference between the initial temperature Tmp0 at the time of start of supplying current to the ultraviolet light irradiation device 31150 and the temperature Tmp1 when a predetermined time has passed after the start of supplying current to the ultraviolet light irradiation device 31150 is smaller than a

predetermined temperature difference (the threshold value), the ultraviolet light irradiation control section 3120 is configured to inform that the ultraviolet light irradiation device 31150 is not in a normal state. Thus, it can be determined that the ultraviolet light irradiation device 31150 does not operate normally with a simple configuration and utilizing characteristics of the ultraviolet light irradiation device 31150 and a user is informed of such an abnormal state.

<Seventeenth Embodiment>

[0234] A seventeenth embodiment will be described with reference to FIGS. 46 to 50. In X-axis, Y-axis, and Z-axis of an orthogonal coordinate system may be present in sections of the drawings except for the drawings including block diagrams and flow charts. The axes in each drawing correspond to the respective axes in other drawings. An X-axis direction, a Y-axis direction, and a Z-axis direction correspond to a right-left direction, a front-rear direction, and an upper-bottom direction, respectively. An upper side (a lower side) and a left side (a right side) in FIG. 47 correspond to an upper side (a lower side) and a front side (a rear side), respectively. One of the same components may be indicated by a symbol and others may be not indicated by the symbols.

[Ice Dispenser 4001]

[0235] In the seventeenth embodiment section, an ice dispenser 4001 (one example of a dispenser as the ice making machine) that dispenses ice pieces 40IC that are made inside the ice dispenser will be described. As illustrated in FIG. 46, the ice dispenser 4001 includes a housing 4010. The housing 4010 has a vertically long box shape as a whole and is supported by legs 4019 that are disposed on four corners of a bottom surface. As illustrated in FIG. 46, an upper protrusion portion 4011U and a lower protrusion portion 4011L are formed on a front surface of the housing 4010 by protruding an upper portion and a lower portion of the housing 4010 frontward. As illustrated in FIG. 47, the upper protrusion portion 4011U is provided at a position with respect to the upper-bottom direction so as to overlap an ice tank 4040. The upper protrusion portion 4011U and the lower protrusion portion 4011L protrude with about a same protrusion dimension (a length in the front-rear direction). The upper protrusion portion 4011U has a width (a length in the right-left direction) that is smaller than that of the lower protrusion portion 4011L. The lower protrusion portion 4011L extends in an area ranging about an entire width of the housing 4010 and the upper protrusion portion 4011U extends only in a middle area.

[0236] As illustrated in FIG. 47, the ice dispenser 4001 includes a freezing device 4020, an ice making mechanism 4030, and the ice tank 4040 (one example of a storing section). The ice making mechanism 4030 is cooled down by the freezing device 4020 and makes ice. The

ice pieces 40IC (one example of drink or food, refer to FIG. 48) that are made by the ice making mechanism 4030 are stored in the ice tank 4040. A device room 4010A is disposed in a rear section of the housing 4010. Devices included in the freezing device 4020 are arranged in the device room 4010A. The ice making mechanism 4030 is disposed in a front lower section of the housing 4010 and the ice tank 4040 is disposed in a front upper section of the housing 4010.

[0237] As illustrated in FIGS. 47 and 48, the ice dispenser 4001 further includes a dispense mechanism 4060, a water discharge mechanism 4070, and an ultraviolet light irradiation device 4080. The dispense mechanism 4060 dispenses the ice pieces 40IC that are made by the ice making mechanism 4030 and stored in the ice tank. The water discharge mechanism 4070 is for discharging water. The ultraviolet light irradiation device 4080 irradiates ultraviolet light to a target object to sterilize it. The upper protrusion portion 4011U includes an outlet hole 4013 on a lower surface thereof. The ice pieces 40IC are dispensed by the dispense mechanism 4060 from the upper protrusion portion 4011U toward the lower protrusion portion 4011L. The ice pieces 40IC that are received by the lower protrusion portion 4011L may melt into water and water is discharged to the outside of the housing 4010 by the water discharge mechanism 4070.

[Freezing Device 4020]

[0238] The ice dispenser 4001 includes the freezing device 4020.

[0239] As illustrated in FIG. 47, the freezing device 4020 includes a compressor 4021, a condenser 4023, a condenser fan 4025, an evaporation pipe 44, and an expansion valve that are connected to each other by refrigerant pipes 4029 that are filled with refrigerant gas. As illustrated in FIG. 47, the compressor 4021, the condenser 4023, and the condenser fan 4025 are arranged in the device room 4010A that is included in a rear section of the housing 4010. The refrigerant gas that is compressed by the compressor 4021 is cooled by the condenser fan 4025 and liquefied by the condenser 4023. The liquefied refrigerant gas is expanded by the expansion valve and vaporized in an evaporation pipe 4027. The evaporation pipe 4027 is wound around an outer surface of a cylinder 4031 of the ice making mechanism 4030. The cylinder 4031 is cooled by heat of vaporization of the refrigerant gas. Purified water supplied to the inside of the cylinder 4031 is frozen on the inner surface of the cylinder 4031 and ice is made. Operation of the freezing device 4020 may be controlled by a control section 4090, which will be described later.

[Ice Making Mechanism 4030]

[0240] The ice dispenser 4001 includes the ice making mechanism 4030 of the auger type. As illustrated in FIG. 47, the ice making mechanism 4030 is disposed in a front

lower section of the housing 4010 and in front of the compressor 4021.

[0241] As illustrated in FIG. 47, the ice making mechanism 4030 includes the cylinder 4031 (the ice making tube, the cooling tube, a freezing casing). The cylinder 4031 is made of metal such as stainless steel and has a tubular shape and extends in the upper-bottom direction. The evaporation pipe 4027 is fitted around an outer peripheral surface of the cylinder 4031 and is covered with a thermal insulation member 4035. The cylinder 4031 includes a water inlet port and a water outlet port in a portion of a sidewall that is lower than the evaporation pipe 4027. Purified water is supplied into the cylinder 4031 through the water inlet port. Purified water that is not used for making ice is discharged outside the cylinder 4031 through the water outlet port.

[0242] As illustrated in FIG. 47, the ice dispenser 4001 according to this embodiment includes a purified water tank 4015 in the housing 4010. The purified water tank 4015 is connected to a water supply system such as a public water supply system and stores purified water that is obtained by filtering tap water. The purified water stored in the purified water tank 4015 is supplied to the cylinder 4031 through a water supply pipe 4017 that is disposed inside the housing 4010.

[0243] As illustrated in FIG. 47, the ice making mechanism 4030 includes an auger 4033. The auger 4033 has a bar shape as a whole and is inserted rotatably in an inner space of the cylinder 4031 so as to extend along a center axis of the cylinder 4031 and in the upper-bottom direction. The auger 4033 includes a spiral scraping blade 4033A in a middle section thereof with respect to the upper-bottom direction that overlaps the evaporation pipe 4027 wound around the cylinder 4031. The scraping blade 4033A protrudes toward an inner surface of the cylinder 4031. The scraping blade 4033A has a protrusion dimension so as not to reach the inner surface of the cylinder 4031. The scraping blade 4033A is rotated to scrape off the ice on the inner surface of the cylinder 4031.

[0244] As illustrated in FIG. 47, the ice making mechanism 4030 includes a compression head 4037. The compression head 4037 is inside the cylinder 4031 and fixed to an upper portion of the cylinder 4031. The compression head 4037 has a tubular shape. An upper portion of the auger 4033 is inserted in the compression head 4037 such that the auger 4033 is rotatably held by the compression head 4037. The compression head 4037 includes grooves, which extend along an axial direction, on an outer peripheral surface. An ice transfer cavity that extends vertically between the compression head 4037 and the inner surface of the cylinder 4031. The ice scraped off from the inner surface of the cylinder 4031 and transferred upward by the auger 4033 is pushed into the ice transfer cavity. The ice is compressed to be in a columnar shape and transferred to the ice tank 4040.

[0245] As illustrated in FIG. 47, the ice making mechanism 4030 includes a driving device 4039. The driving device 4039 includes a motor 4039A, a gear system, and an output shaft 4039B and is disposed below the cylinder 4031. The lower end of the auger 4033 is connected to an upper end of the output shaft 4039B. As the motor is driven and the output shaft 4039B rotates, the auger 4033 rotates. The driving of the driving device 4039 may be controlled by the control section 4090, which will be described later.

[Ice Tank 4040]

[0246] The ice dispenser 4001 includes the ice tank 4040. As illustrated in FIG. 47, the ice tank 4040 is disposed in a front upper section of the housing or above the ice making mechanism 4030.

[0247] As illustrated in FIG. 47, the ice tank 4040 includes a tank body 4041 and a cover 4043. The tank body 4041 has a cylindrical box shape as a whole. The cover 4043 is fixed to an upper section of the tank body 4041. The tank body 4041 has a double box structure and includes an outer box 4041A and an inner box 4041B that is disposed inside the outer box 4041A with a space therebetween. A thermal insulation member 4041C is disposed between the outer box 4041A and the inner box 4041B. The tank body 4041 includes a through hole 4045 in a center of a bottom wall and the through hole 4045 extends through the bottom wall. The tank body 4041 and the cylinder 4031 are connected to each other with bolts via sealing material in a watertight manner with the upper end portion of the ice making mechanism 4030 being inserted in the through hole 4045. According to such a configuration, the compression head 4037, which is previously described, is held with the upper end portion thereof protruding upward from the bottom wall of the inner box 4041B to the inner space of the ice tank 4040.

[0248] As illustrated in FIG. 47, in the tank body 4041, the bottom wall of the outer box 4041A extends about horizontally in a flat manner, while the bottom wall of the inner box 4041B is inclined downward as it extends from a middle of the bottom wall where the compression head 4037 is inserted toward the outer periphery. A duckboard 4047 (one example of a drainer) that includes through holes and is permeable is disposed on the bottom wall of the inner box 4041B. The duckboard 4047 extends slightly upward in a middle section from the upper end portion of the compression head 4037 (until a distance between the duckboard 4047 and a tapered surface 4049A1 of a rotary member 4049, which will be described later, becomes a predefined distance) and extends downward along the sloped bottom wall of the inner box 4041B.

[0249] As illustrated in FIG. 47, the ice tank 4040 includes the rotary member 4049. The rotary member 4049 is disposed above the compression head 4037 that protrudes from the bottom wall of the tank body 4041. The rotary member 4049 includes a shaft member 4049A and fins 4049B. A lower end of the shaft member 4049A is

connected to an upper end of the auger 4033 and the shaft member 4049A rotates together with the auger 4033. The shaft member 4049A has the tapered surface 4049A1 on a portion of a lower side surface. The ice block that is obtained by compressed by the compression head 4037 is pushed upward from the ice transfer cavity by the compression head 4037 and is broken by the tapered surface 4049A1 and cut into pieces having a predefined length and ice pieces 401C are obtained. The fins 4049B extend from the shaft member 4049A toward the outer periphery of the tank body 4041 and move inside the tank body 4041 according to the rotation of the shaft member 4049A. Accordingly, the fins 4049B function as an agitator that agitates the ice pieces 401C such that the ice pieces 401C do not join together.

[0250] As illustrated in FIGS. 47 and 48, the tank body 4041 includes a discharge hole 4048 in a lower end portion of the front wall. The discharge hole 4048 extends through the front wall. The ice pieces 401C that are obtained by cutting with the shaft member 4049A of the rotary member 4049 slide along the sloped upper surface of the duckboard 4047 with being agitated by the fins 4049B and are transferred to the discharge hole 4048.

[Dispense Mechanism 4060]

[0251] The ice dispenser 4001 includes the dispense mechanism 4060. As illustrated in FIGS. 47 and 48, the dispense mechanism 4060 is disposed in the front section of the housing 4010 and in the upper protrusion portion 4011U.

[0252] As illustrated in FIG. 48, the dispense mechanism 4060 includes a shutter 4061. The shutter 4061 is disposed in front of the discharge hole 4048 inside the upper protrusion portion 4011U. The shutter 4061 is a normally-closed type shutter and contacted with the discharge hole 4048 from the front side so as to close and open the discharge hole 4048. As illustrated in FIG. 48, the shutter 4061 includes a mount plate 4061A made of metal, a thick plate 4061B made of metal for reinforcement, an L-shaped plate 4061C that suppresses scattering of drink or food, and a screw 4061D. The thick plate 4061B and the L-shaped plate 4061C are fixed to the front surface of the mount plate 4061A with the screw 4061D. A sealing material that is elastic resin is bonded to the portion of the rear surface of the mount plate 4061A that is to be contacted with the discharge hole 4048. The mount plate 4061A is connected to a coupling plate 4062C of a solenoid device 4062.

[0253] As illustrated in FIG. 48, the dispense mechanism 4060 includes the solenoid device 4062. The solenoid device 4062 is disposed above the shutter 4061 inside the upper protrusion portion 4011U. As illustrated in FIG. 48, the solenoid device 4062 includes a solenoid body 4062A including an electromagnetic coil, a plunger 4062B that moves up and down according to movement of the electromagnetic coil, and the coupling plate 4062C that connects the mount plate 4061A and the plunger

4062B. If a lever switch 4065 or a touch switch 4067 turns on, the electromagnetic coil inside the solenoid body 4062A is excited and the plunger 4062B, which is normally disposed in a lowered position, moves upward. This rotates the shutter 4061, which is connected to the plunger 4062B, about the upper end of the shutter 4061 and the discharge hole 4048 is opened. The shutter 4061 that is operated by the solenoid device is one example and known shutters that are opened and closed by various mechanisms may be used.

[0254] As illustrated in FIG. 48, the dispense mechanism 4060 includes a guide member 4063. The guide member 4063 is disposed below the discharge hole 4048 inside the upper protrusion portion 4011U. As illustrated in FIG. 48, the guide member 4063 according to this embodiment includes a bottom wall and side walls. The bottom wall extends downward from a lower hole edge of the discharge hole 4048 and the side walls extend upward from right and left side edges of the bottom wall. The guide member 4063 has a U-shaped cross-section that opens upward.

[0255] As illustrated in FIG. 48, the dispense mechanism 4060 includes a cover member 4064. The cover member 4064 is disposed on a lower front side of the guide member 4063 inside the upper protrusion portion 4011U. As illustrated in FIG. 48, the cover member 4064 according to this embodiment includes a front wall, right and left side walls, a lower wall. The front wall covers the guide member 4063 from the front side. The right and left side walls extend rearward from right and left side edges of the front wall. The lower wall is on a lower side of the guide member 4063. The ice pieces 401C that are discharged through the discharge hole 4048 are guided to the outlet hole 4013 by the guide member 4063 and the cover member 4064.

[0256] As illustrated in FIG. 48, the cover member 4064 according to this embodiment includes a pipe holder 4064A that has a circular tubular shape and extends in the upper-bottom direction. The water supply pipe 4017 that is connected to a water supply system such as public water pipe is fitted to the pipe holder 4064A. According to such a configuration, the ice dispenser 4001 is configured to dispense the ice pieces 401C and purified water through the outlet hole 4013.

[0257] As illustrated in FIG. 48 and other drawings, the dispense mechanism 4060 includes the lever switch 4065. As illustrated in FIG. 48, the lever switch 4065 according to this embodiment includes an operation lever 4065A and a switch body 4065B. The operation lever 4065A extends downward from a lower surface of the upper protrusion portion 4011U and is below the outlet hole 4013. The operation lever 4065A is supported so as to be rotated against an elastic force of a spring when a cup 4000C is contacted with and pushes the operation lever 4065A. A magnet is embedded in the operation lever 4065A. The switch body 4065B is disposed at a position such that the operation lever 4065A moves rearward and comes in contact with the switch body 4065B

inside the housing 4010. A lead switch that is responsive to a magnet is included in the switch body 4065B. If the operation lever 4065A is pushed by the cup 4000C, the lead switch, which is included in the switch body 4065B, turns on. If the cup 4000C is removed, the operation lever 4065A returns to an initial position and the switch turns off.

[0258] As illustrated in FIG. 48 and other drawings, the dispense mechanism 4060 includes the touch switch 4067. The touch switch 4067 according to this embodiment is disposed on a front surface of the upper protrusion portion 4011U. If a user touches the surface with the user's finger, electrostatic capacitance inside the switch changes and the switch turns on. If the finger is away from the surface, the switch turns off. The switch is not limited to be the one configured to be on and off according to the above operation but any known switches may be used. A switch including a contact point inside a circuit that is connected or disconnected by a user's operation may be used. If detecting that any object is placed on a stage 4071, which will be described later, the discharge hole 4048 may be automatically opened. If a predetermined time passes after the switch turns on, the switch may turn off.

[0259] If the lever switch 4065 or the touch switch 4067 turns on according to the operation of the user, the shutter 4061 uncovers the discharge hole 4048 and the ice pieces 401C inside the ice tank 4040 are guided from the discharge hole 4048 to the outlet hole 4013 by the guide member 4063 and the cover member 4064 and dispensed to the cup 4000C. If the lever switch 4065 or the touch switch 4067 turns off, the shutter 4061 closes the discharge hole 4048 to stop discharging of the ice pieces 401C.

[Water Discharge Mechanism 4070]

[0260] The ice dispenser 4001 includes the water discharge mechanism 4070. As illustrated in FIGS. 47 and 48, the water discharge mechanism 4070 is disposed in bottom sections of the lower protrusion portion 3011L and the housing 4010.

[0261] As illustrated in FIG. 48, the water discharge mechanism 4070 includes the stage 4071. The stage 4071 is a permeable plate member that includes holes and is disposed to be about parallel to the upper surface of the lower protrusion portion 4011L. The cup 4000C for receiving the discharged ice pieces 401C is placed on the stage 4071.

[0262] As illustrated in FIG. 48, the water discharge mechanism 4070 includes an outer drain pan 4072. The outer drain pan 4072 is disposed under the stage 4071 in the lower protrusion portion 4011L. The outer drain pan 4072 includes a step portion 4072A on an upper portion of an inner surface. The stage 4071 is fitted to the step portion 4072A. Purified water that is not received by the cup 4000C and spills or water melted from the ice pieces 401C drops from the permeable stage 4071 and

is received by the outer drain pan 4072. A cavity 4072B extends through a rear wall of the outer drain pan 4072 toward the ice making mechanism 4030 that is disposed behind the outer drain pan 4072. The cavity 4072B has a U-shaped cross section and a rear end portion of the cavity 4072B is disposed above an inner drain pan 4073, which will be described later. A bottom surface of the outer drain pan 4072 is sloped such that a basal end of the cavity 4072B is lowest. A bottom surface of the cavity 4072B is sloped downward as it extends rearward. According to such a configuration, drain water received by the outer drain pan 4072 flows down through the cavity 4072B and flows from the rear end of the cavity 4072B to the inner drain pan 4073.

[0263] As illustrated in FIG. 48, the water discharge mechanism 4070 includes the inner drain pan 4073. The inner drain pan 4073 is disposed below the driving device 4039 of the ice making mechanism 4030, which is previously described. In addition to melted water from frost on the evaporation pipe 4027 and purified water discharged from the cylinder 4031, water flowing down from the outer drain pan 4072 through the cavity 4072B are collected to the inner drain pan 4073.

[0264] As illustrated in FIG. 48, the water discharge mechanism 4070 includes a water discharge pipe 4074. The water discharge pipe 4074 is coupled to the bottom wall of the inner drain pan 4073 and extends outside the housing 4010 from a lower section of the housing 4010. Drain water in the inner drain pan 4073 is discharged outside the ice dispenser 4001 through the water discharge pipe 4074.

[Ultraviolet Light Irradiation Device 4080]

[0265] The ice dispenser 4001 includes the ultraviolet light irradiation device 4080. The ultraviolet light irradiation device 4080 may include an ultraviolet light lamp or an ultraviolet light emitting diode (UV-LED). Ultraviolet light (UV) that is emitted by the ultraviolet light irradiation device 4080 has a wavelength of about 200 nm or longer and 300 nm or shorter and has high sterilizing effects. More preferably, the ultraviolet light preferably has a wavelength of about 220 nm or longer and 280 nm or shorter, and much more preferably, deep ultraviolet rays (UV) having a wavelength of 253 nm or longer and 285 nm or shorter may be emitted.

[0266] As illustrated in FIG. 48 and other drawings, the ultraviolet light irradiation device 4080 of this embodiment is mounted on a rear surface of the front wall of the cover member 4064. The ultraviolet light irradiation device 4080 is disposed slightly lower than an upper edge of the front wall of the cover member 4064 with respect to the upper-bottom direction. The ultraviolet light irradiation device 4080 can irradiate ultraviolet light rearward in a wide range. For example, as illustrated by arrows with dashed lines in FIG. 48, the ultraviolet light irradiation device 4080 can irradiate ultraviolet light in a range including a whole guide member 4063, the shutter 4061,

and the discharge hole 4048. Accordingly, when the ice pieces 401C are discharged through the discharge hole 4048, the discharged ice pieces 401C are surely irradiated with ultraviolet light.

[Control Section 4090]

[0267] The ice dispenser 4001 according to this embodiment further includes the control section 4090 (refer to FIG. 49) that controls ultraviolet light irradiation from the ultraviolet light irradiation device 4080. The control section 4090 includes a computer, which includes a CPU, a RAM, and a ROM, as a main component and is arranged in a control box 4090A that is disposed behind the ice tank 4040 as illustrated in FIG. 47.

[0268] The ultraviolet light irradiation device 4080 is configured to irradiate ultraviolet light with at least two types of irradiation intensities including LOW (low irradiation intensity) and HIGH (high irradiation intensity). Specifically, the irradiation intensity of LOW is from $0.1 \mu\text{W}/\text{cm}^2$ to $1000 \mu\text{W}/\text{cm}^2$ and the irradiation intensity of HIGH is from $0.1 \text{mW}/\text{cm}^2$ to $1000 \text{mW}/\text{cm}^2$. The irradiation intensity of LOW may be set with considering an installation place of the ice dispenser (whether bacteria easily grows or not), a kind of drink or food to be dispensed (whether bacteria easily grows or not), and a mount position of the ultraviolet light irradiation device 4080 (whether ultraviolet easily leaks outside, whether a target object has complicated structure). The irradiation intensity of HIGH may be set with considering a kind of drink or food to be discharged or dispensed (whether the drink or food is easy to be sterilized with ultraviolet light) and time that is required for the food or drink to pass through the ultraviolet light irradiation area. For instance, when the irradiation is performed to the ice pieces 401C to be discharged or dispensed as is in this embodiment, the irradiation intensity of LOW is preferably set from $1 \mu\text{W}/\text{cm}^2$ to $100 \mu\text{W}/\text{cm}^2$ and the irradiation intensity of HIGH is preferably set from $1 \text{mW}/\text{cm}^2$ to $100 \text{mW}/\text{cm}^2$.

[0269] As illustrated in FIG. 49, the control section 4090 is connected to the lever switch 4065 and the touch switch 4067 in addition to the ultraviolet light irradiation device 4080 to control the irradiation intensity of ultraviolet light irradiated by the ultraviolet light irradiation device 4080. As previously described, in the dispense mechanism 4060 of this embodiment, the shutter 4061 is configured to open and close the discharge hole 4048 according to ON and OFF of the lever switch 4065 and the touch switch 4067. Therefore, if the lever switch 4065 and the touch switch 4067 turn on or off, it is determined that the shutter 4061 opens or closes the discharge hole 4048 and control is performed accordingly. Namely, in this embodiment, the lever switch 4065 and the touch switch 4067 function as shutter detection means that detects whether the shutter 4061 is open or closed.

[0270] One example of a control process of controlling the ultraviolet light irradiation device 4080 by the control section 4090 will be described with reference to FIG. 50.

[0271] As illustrated in FIG. 50, if the control process is started, the control section 4090 controls the ultraviolet light irradiation device 4080 to irradiate ultraviolet light (step S4001). The irradiation intensity is LOW and the ultraviolet light irradiation at the low irradiation intensity is maintained until it is detected that the lever switch 4065 or the touch switch 4067 turns on.

[0272] After step S4001, if it is detected that one of the lever switch 4065 and the touch switch 4067 turns on (Yes at step S4002), the control section 4090 increases the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device 4080 (step S4003). The irradiation intensity is currently HIGH and the ultraviolet light irradiation at the high irradiation intensity is maintained until it is detected that the lever switch 4065 and the touch switch 4067 turn off.

[0273] After step S4003, if it is detected that both of the lever switch 4065 and the touch switch 4067 turn off (Yes at step S4004), the control section 4090 decreases the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device 4080 (step S4005). Then, the process returns to step S4002 and process steps from steps S4002 to S4005 will be performed repeatedly (* 1).

[0274] The control process described above will be described with reference to an operation state of the ice dispenser 4001.

[0275] When the ice dispenser 4001 that is in the standby state is used, ultraviolet light is irradiated at low irradiation intensity as is in the process in step S4001 and a user puts the cup 4000C below the outlet hole 4013 and pushes the lever switch 4065 with the cup 4000C or puts the cup 4000C on the stage 4071 and touches the touch switch 4067. This makes the lever switch 4065 or the touch switch 4067 to be turned on (Yes at step S4002) and the irradiation intensity of ultraviolet light is increased (step S4003). In the dispense mechanism 4060, the shutter 4061 uncovers the discharge hole 4048 and the ice pieces 401C are discharged and guided to the outlet hole 4013 by the guide member 4063 and the cover member 4064. The ice pieces 401C passing through the ultraviolet light irradiation area are irradiated with ultraviolet light at high irradiation intensity. Therefore, the ice pieces 401C can be sterilized in a short time.

[0276] If the cup 4000C receives a sufficient amount of ice pieces 401C, the user turns off the switch, which has been on. If both of the lever switch 4065 and the touch switch 4067 are turned off (Yes at step S4004), the shutter 4061 closes the discharge hole 4048 and discharge of the ice pieces 401C stops. Accordingly, the irradiation intensity of ultraviolet light is decreased (step S4005) and the ice dispenser 4001 returns to the standby state. In the standby state, ultraviolet light irradiation at the low irradiation intensity is maintained with suppressing energy consumption and the section adjacent to the discharge hole 4048 including the front surface of the closed shutter is sterilized. Thus, a discharge cavity of the ice pieces 401C can be kept clean.

[Summary of Configuration, Operations and Effects]

[0277] As described above, the ice dispenser 4001 (one example of the dispenser) according to the seventeenth embodiment includes the housing 4010 (one example of the storing section), the ice tank 4040, the shutter 4061, the touch switch 4067 (one example of the shutter detection means), the lever switch 4065 (one example of the shutter detection means), the ultraviolet light irradiation device 4080, and the control section 4090. The ice tank 4040 is disposed in the housing and stores the ice pieces IC (one example of drink or food) and includes the discharge hole 4048. The shutter 4061 covers and uncovers the discharge hole 4048. The touch switch 4067 and the lever switch 4065 detect an open state and a closed state of the shutter 4061. The ultraviolet light irradiation device 4080 irradiates ultraviolet light to the ice pieces 40IC that are discharged through the discharge hole 4048 to perform sterilization. The control section 4090 controls ultraviolet light irradiation by the ultraviolet light irradiation device 4080 according to the open state or the closed state of the shutter 4061 that is detected by the touch switch 4067 and the lever switch 4065.

[0278] According to such a configuration, since the ultraviolet light irradiation intensity can be controlled according to the open state and the closed state of the shutter 4061, ultraviolet light having high intensity can be irradiated only while the ice pieces 40IC are being discharged. Therefore, the ice pieces 40IC themselves can be sterilized without excessively increasing consumption energy. As a result, the ice pieces 40IC having high safety can be supplied. By shortening the time while the ultraviolet light having high intensity is irradiated, the ultraviolet light is less likely to leak outside the ice dispenser 4001. Therefore, the ultraviolet light is less likely to hit a user's hand and health damage is less likely to be caused.

[0279] In this embodiment, ultraviolet light is irradiated to the ice pieces 40IC, which are drink or food; however, the drink or food may not be limited to the ice pieces. The drink or food may be liquid, solid, or mixture of solid and liquid. As previously described, the irradiation intensity of ultraviolet light may be preferably set based on velocity of the drink or food that is an irradiation target.

[0280] In the ice dispenser 4001, if the control section 4090 determines that the shutter 4061 uncovers the discharge hole 4048, the control section 4090 increases the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device 4080. If the control section 4090 determines that the shutter 4061 closes the discharge hole 4048 after increasing the irradiation intensity, the control section 4090 decreases the irradiation intensity.

[0281] Specifically, with the above-described control process, the sterilization of drink or food to be supplied is performed effectively.

[0282] In this embodiment, the control section 4090 determines that the shutter 4061 covers or uncovers the

discharge hole 4048 based on signals from the touch switch 4067 and the lever switch 4065, which function as the shutter detection means; however, it is not limited thereto. A time counter means counting time such as a timer may be further included and it may be determined that the shutter 4061 closes the discharge hole 4048 if a predefined time passes after the increase of the ultraviolet light irradiation intensity.

[0283] In this embodiment, the control section is configured to control the ultraviolet light irradiation device to irradiate ultraviolet light at a constant irradiation intensity higher than $0 \mu\text{W}/\text{cm}^2$ before increasing the irradiation intensity and after decreasing the irradiation intensity. Accordingly, not only the ice pieces 40IC themselves can be sterilized when the ice pieces 40IC being discharged but also the discharge cavity of the ice pieces 40IC can be sterilized and maintained clean in the standby state. As a result, the ice pieces 40IC having high safety can be supplied.

<Eighteenth Embodiment>

[0284] An eighteenth embodiment will be described with reference to FIGS. 51 to 53. In the forty seventh embodiment, an ice dispenser 4201 (the ice making machine) includes an outlet hole cover 4250 in a front surface of a housing 4210. The discharge hole cover 4250 covers a space between the outlet hole 4013 and the stage 4071. A basic configuration of the ice dispenser 4201 is similar to that of the ice dispenser 4001 of the seventeenth embodiment. In the following, configurations of the ice dispenser 4201 that differ from those of the ice dispenser 4001 will be described and the configurations of the ice dispenser 4201 similar to those of the ice dispenser 4001 are represented by the same symbols of those of the seventeenth embodiment and will not be described (same in a nineteenth embodiment and subsequent embodiments).

[Outlet Hole Cover 4250]

[0285] The ice dispenser 4201 includes the outlet hole cover 4250. As illustrated in FIG. 51, the outlet hole cover 4250 is mounted in a space between the upper protrusion portion 4011U and the lower protrusion portion 4011L.

[0286] The outlet hole cover 4250 can block ultraviolet light and transmit visible light. In this embodiment, a resin member is entirely and integrally molded with using resin that blocks ultraviolet light and transmits visible light and such a resin member is used as the outlet hole cover 4250. Examples of such resin includes acrylic resin and polycarbonate resin that are light transmissive. The outlet hole cover 4250 is mounted on the front surface of the housing 4210 so as to be opened and closed and has a U-shaped cross section opening rearward. As illustrated in FIG. 51, in the closed state, the outlet hole cover 4250 is continuous from a lower end of the upper protrusion portion 4011U to close a space that includes the outlet

hole 4013 and extends to a middle of the stage 4071. The outlet hole cover 4250 of this embodiment can be opened by being rotated around a left edge (in FIG. 51) seen from the front surface of the ice dispenser 4201. The entire outlet hole cover 4250 is not necessarily made of resin that blocks ultraviolet light and transmits visible light but an ultraviolet light blocking member including a window through which visible light can pass may be used.

[0287] The outlet hole cover 4250 is preferably closed normally. A user opens the outlet hole cover 4250 and puts a container such as the cup 4000C on the stage 4071 that is below the outlet hole 4013. After closing the outlet hole cover 4250, the user operates the touch switch 4067, for example, such that the ice pieces 401C or purified water is dispensed into the container. After the dispensing is finished, the user opens the outlet hole cover 4250 again and takes out the container filled with the ice pieces 401C and closes the outlet hole cover 4250.

[Cover Opening and Closing Detection Sensor 4251]

[0288] The ice dispenser 4201 includes a cover opening and closing detection sensor 4251 (one example of cover detection means) that detects an open state and a closed state of the outlet hole cover 4250. A contactless sensor such as an infrared sensor that is mounted at an appropriate position of the housing 4210 may be used as the cover opening and closing detection sensor 4251. A magnet and a lead switch may be used as the cover opening and closing detection sensor 4251. The magnet is attached to a moving-side edge (a right edge in FIG. 51) of the outlet hole cover 4250 and the lead switch is embedded in a portion of the housing 4210 where the magnet approaches the lead switch when the outlet hole cover 4250 is closed. As illustrated in FIG. 52, the cover opening and closing detection sensor 4251 is connected to a control section 4290 that will be described later.

[Ultraviolet Light Irradiation Device 4280]

[0289] The ice dispenser 4201 includes an ultraviolet light irradiation device 4280. The ultraviolet light irradiation device 4280 of this embodiment can simultaneously irradiate ultraviolet light and visible light that has a wavelength of 380 nm to 780 nm. By irradiating ultraviolet light and visible light simultaneously, performance of ultraviolet light irradiation and an area of the ultraviolet light irradiation can be confirmed visually. The ultraviolet light irradiation device 4280 according to this embodiment is mounted at a same position as the ultraviolet light irradiation device 4080 of the seventeenth embodiment is, for instance. As illustrated in FIG. 52, the ultraviolet light irradiation device 4280 is connected to the control section 4290, which will be described later.

[Control Section 4290]

[0290] The ice dispenser 4201 includes the control

section 4290 that controls ultraviolet light irradiation from the ultraviolet light irradiation device 4280. As illustrated in FIG. 52, the control section 4290 is connected to the touch switch 4067, the cover opening and closing detection sensor 4251, and the ultraviolet light irradiation device 4280. In this embodiment, the shutter 4061 is configured to open and close the discharge hole 4048 according to the operation of the touch switch 4067. The touch switch 4067 functions as the shutter detection means that detects the opening and closing of the shutter 4061.

[0291] One example of a control process of the ultraviolet light irradiation device 4280 performed by a control section 4290 will be described below with reference to FIG. 53.

[0292] As illustrated in FIG. 53, if the control is started, the control section 4290 determines whether the outlet hole cover 4250 is closed (step S4021). If determining that the outlet hole cover 4250 is closed (Yes at step S4021), the control section 4290 controls the ultraviolet light irradiation device 4280 to irradiate ultraviolet light and visible light (step S4022). The irradiation intensity of ultraviolet light is LOW and the ultraviolet light irradiation at the low irradiation intensity is continued until it is detected that the outlet hole cover 4250 is opened (No at step S4023) or the touch switch 4067 turns on.

[0293] If determining that the outlet hole cover 4250 is opened (No at step S4023) after step S4022, the control section 4290 stops irradiation of ultraviolet light and visible light (step S4024) and returns to step S4021 and performs steps of the control process (*2). If detecting that the touch switch 4067 turns on (Yes at step S4025) without the outlet hole cover 4250 being opened (Yes at step S4023), the control section 4290 determines whether the outlet hole cover 4250 is closed (step S4026). If determining that the outlet hole cover 4250 is opened, the control section 4290 stops irradiation of ultraviolet light and visible light (step S4027) and returns to step S4021 and performs steps of the control process (*2) again. If determining that the outlet hole cover 4250 is closed (Yes at step S4026) after the touch switch 4067 turns on, the control section 4290 increases irradiation intensity of ultraviolet light emitted by the ultraviolet light irradiation device 4280 (step S4028). The irradiation intensity of ultraviolet light is HIGH and the ultraviolet light irradiation at the high irradiation intensity is continued until it is detected that the outlet hole cover 4250 is opened (No at step S4029).

[0294] If determining that the outlet hole cover 4250 is opened (No at step S4029) after step S4023, the control section 4290 stops irradiation of ultraviolet light and visible light from the ultraviolet light irradiation device 4280 (step S4030) and returns to step S4021 and performs steps of the control process (*2) again.

[0295] The control process described above will be described with reference to an operation state of the ice dispenser 4001.

[0296] When the ice dispenser 4001 that is in the stand-

by state is used, ultraviolet light is irradiated at low irradiation intensity as is in the process in step S4022 and a user opens the outlet hole cover 4250 and puts the cup 4000C on the stage 4071 and closes the outlet hole cover 4250. If it is detected that the outlet hole cover 4250 is opened (No at step S4023), ultraviolet light irradiation and visible light irradiation are stopped (step S4024). Therefore, the user's hand is not exposed to the irradiated ultraviolet light when the user sets the cup 4000C. If the outlet hole cover 4250 is closed (Yes at step S4021) after the user sets the cup 4000C, the ultraviolet light irradiation device 4080 irradiates ultraviolet light at low irradiation intensity again (step S4022).

[0297] Thereafter, If the user touches and turns on the touch switch 4067 (Yes at step S4025) without opening the outlet hole cover 4250 (Yes at step S4025), it is confirmed that the outlet hole cover 4250 is closed (Yes at step S4026). Then, the irradiation intensity of ultraviolet light is increased (step S4028) and ultraviolet light is irradiated at a high irradiation intensity to the ice pieces 401C discharged through the discharge hole 4048 that is opened by opening of the shutter 4061. Visible light is irradiated together with the ultraviolet light and the user can check the sterilization via the outlet hole cover 4250.

[0298] If the cup 4000C receives a sufficient amount of ice pieces 401C, the user turns off the touch switch 4067 and opens the outlet hole cover 4250 and takes out the cup 4000C. Then, the user closes the outlet hole cover 4250. The ultraviolet light irradiation and the visible light irradiation are stopped (step S4030) when the outlet hole cover 4250 is opened (No at step S4029). Therefore, when the user takes out the cup 4000C, the user's hand is not exposed to ultraviolet light. If the user takes out the cup 4000C and closes the outlet hole cover 4250 (Yes at step S4021), the ultraviolet light irradiation device 4080 irradiates ultraviolet light at a low irradiation intensity again (step S4022) and returns to the standby state. The control section 4290 may decrease the irradiation intensity of ultraviolet light irradiated by the ultraviolet light irradiation device 4280 when the touch switch 4067 turns off.

[Summary of Configuration, Operations and Effects]

[0299] As previously described, in the ice dispenser 4201 according to the eighteenth embodiment, the housing 4210 includes the outlet hole 4013 that is communicated with the discharge hole 4048. The ice pieces 401C that are discharged through the discharge hole 4048 are dispensed outside the housing 4210 through the outlet hole 4013. The stage 4071 is disposed below the outlet hole 4013 and the cup 4000C (one example of the container) for receiving the ice pieces 401C that are dispensed through the outlet hole 4013 is placed on the stage 4071. The outlet hole cover 4250 is mounted to cover the space between the outlet hole 4013 and the stage 4071 so as to be closed and opened. The cover opening and closing detection sensor 4251 (one example

of the cover detection means) that detects an open state and a closed state of the outlet hole cover 4250 is further included. The control section 4290 does not increase the irradiation intensity of ultraviolet light irradiated by the ultraviolet light irradiation device 4280 when the cover opening and closing detection sensor 4251 does not detect that the outlet hole cover 4250 is closed.

[0300] According to the above configuration, when the outlet hole cover 4250 is not closed, ultraviolet light is not irradiated at a high intensity. Therefore, the ultraviolet light having high intensity is less likely to hit a user's hand and health damage is less likely to be caused.

[0301] In this embodiment, the control section 4290 stops the ultraviolet light irradiation by the ultraviolet light irradiation device 4280 if not detecting that the outlet hole cover 4250 is closed. This further increases users' safety.

[0302] In the ice dispenser 4201, the ultraviolet light irradiation device 4280 can emit ultraviolet light and visible light, and the outlet hole cover 4250 includes a visible light transmission portion that blocks ultraviolet light and transmits visible light.

[0303] According to such a configuration, the ultraviolet light irradiation device 4280 emits visible light and ultraviolet light and the emission of the ultraviolet light and the visible light can be visually checked through the outlet hole cover 4250. Therefore, a trouble in the ultraviolet light irradiation device 4280 can be noticed early. A user can check that ultraviolet light is not emitted when the user opens the outlet hole cover 4250 and takes out the cup 4000C. As a result, safety for users can be further improved.

<Nineteenth Embodiment>

[0304] A nineteenth embodiment will be described with reference to FIG. 54. In the nineteenth embodiment, a mount position of an ultraviolet light irradiation device 4380 differs from the mount position of the ultraviolet light irradiation device 4080 according to the seventeenth embodiment. Other configurations of an ice dispenser 4301 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4380]

[0305] In this embodiment, as illustrated in FIG. 54, the ultraviolet light irradiation device 4380 is mounted on a lower surface of the duckboard 4047 (one example of the drainer). In this embodiment, the ultraviolet light irradiation device 4380 is mounted on a portion of the duckboard 4047 adjacent to the discharge hole 4048. The ultraviolet light irradiation device 4380 irradiates ultraviolet light upward. The duckboard 4047 includes through holes to exert permeability. Ultraviolet light travels through the through holes and reaches the ice pieces 401C that are disposed on an upper surface of the duckboard 4047. The ultraviolet light irradiation device 4380 according to this embodiment irradiates ultraviolet light

in a wide-angle range in an upper area. As illustrated by arrows with dashed lines in FIG. 54, when the shutter 4061 is closed, ultraviolet light can be irradiated to a rear surface of the shutter 4061.

[Summary of Configuration, Operations and Effects]

[0306] The ice dispenser 4301 according to the nineteenth embodiment includes the duckboard 4047 (one example of the drainer), which transmits ultraviolet light, on the bottom surface of the ice tank 4040 (one example of the storing section). The ultraviolet light irradiation device 4380 is mounted on the lower surface of the duckboard 4047 so as to irradiate ultraviolet light upward.

[0307] According to the above configuration, ultraviolet light can be irradiated to the ice pieces 401C that move along the upper surface of the duckboard 4047 toward the discharge hole 4048. Particularly in this embodiment, the ultraviolet light irradiation device 4380 is disposed on a bottom surface adjacent to the discharge hole 4048. Therefore, the ice pieces 401C that are to be discharged next can be sterilized intensively. The ultraviolet light irradiation device 4380 is disposed in the ice tank 4040 and ultraviolet light is basically irradiated toward the inside of the ice tank 4040. Therefore, ultraviolet light is less likely to leak outside the housing 4010. Particularly in this embodiment, the ultraviolet light irradiation device 4380 can irradiate ultraviolet light to the ice tank 4040, which is disposed in an upper section, and also to the discharge hole 4048. Therefore, when the shutter 4061 is closed, the rear surface of the shutter 4061 (a surface opposite the ice tank 4040) is irradiated with ultraviolet light. When the shutter is open, a portion of the discharge cavity (the guide member 4063 and an upper portion of the cover member 4064) is also irradiated with ultraviolet light. Thus, the portions irradiated with ultraviolet light can be sterilized.

<Twentieth Embodiment>

[0308] A twentieth embodiment will be described with reference to FIG. 55. In the twentieth embodiment, a mount position of an ultraviolet light irradiation device 4480 differs from the mount position of the ultraviolet light irradiation device 4080 according to the seventeenth embodiment. Other configurations of an ice dispenser 4401 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4480]

[0309] In this embodiment, as illustrated in FIG. 55, the ultraviolet light irradiation device 4480 is mounted on a rear surface of the front wall of the cover member 4064 similar to the ultraviolet light irradiation device 4080 of the seventeenth embodiment. The mount position of the ultraviolet light irradiation device 4480 with respect to the upper-bottom direction differs from that of the ultraviolet

light irradiation device 4080 according to the seventeenth embodiment. The ultraviolet light irradiation device 4480 is disposed on an upper edge portion of the front wall of the cover member 4064 and directly opposite the front surface of the shutter 4061 that covers the discharge hole 4048 from the front side. The ultraviolet light irradiation device 4480 irradiates ultraviolet light rearward. As illustrated by arrows of dashed lines in FIG. 55, the ultraviolet light irradiation device 4480 can irradiate ultraviolet light at a high intensity with a relatively small distance from the shutter 4061.

[Summary of Configuration, Operations and Effects]

[0310] In the ice dispenser 4401 according to the twentieth embodiment, the shutter 4061 is mounted to cover the discharge hole 4048 from the front side. The ultraviolet light irradiation device 4480 is mounted at the position in the housing 4010 so as to be directly opposite the shutter 4061 from the front side and irradiate ultraviolet light rearward.

[0311] The guide member 4063 and the cover member 4064 that are configured as a portion of the discharge cavity of the ice pieces 401C is communicated to the outside. The shutter 4061 separates the discharge cavity and the ice tank 4040 that is normally closed. The shutter 4061 may be made of metal that has good durability against the repetitive opening and closing. With such a configuration, thermal insulation properties are less likely to be maintained and condensation is likely to be caused on the front surface of the shutter 4061 that faces the discharge cavity. Splashes of drink or food such as the discharged ice pieces 401C may adhere to the front surface of the shutter 4061. Furthermore, as previously described in the seventeenth embodiment, the shutter 4061 has a complicated shape to exert a good closing and opening function. This makes it difficult to clean the shutter. As a result, bacteria are likely to grow on the front surface of the shutter 4061. According to the above configuration, ultraviolet light can be intensively irradiated to the front surface of the shutter to perform sterilization surely.

<Twenty-first Embodiment>

[0312] A twenty-first embodiment will be described with reference to FIG. 56. In the twenty-first embodiment, a configuration and a mount position of an ultraviolet light irradiation device 4580 differ from those of the ultraviolet light irradiation device 4080 of the seventeenth embodiment. Other configurations of an ice dispenser 4501 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4580]

[0313] The ultraviolet light irradiation device 4580 according to this embodiment emits ultraviolet light and vis-

ible light. In this embodiment, as illustrated in FIG. 56, the ultraviolet light irradiation device 4580 is mounted on a rear surface of the front wall of the cover member 4064. As to the mount position with respect to the upper-bottom direction, the ultraviolet light irradiation device 4580 is disposed on the upper edge portion of the front wall of the cover member 4064. However, unlike the ultraviolet light irradiation device 4480 of the twentieth embodiment, the ultraviolet light irradiation device 4580 is mounted obliquely to face a lower rear side. The ultraviolet light irradiation device 4580 can irradiate ultraviolet light in a wide-angle area ranging from a rear side to a lower side. As illustrated by arrows with dashed lines in FIG. 56, ultraviolet light can be irradiated to the shutter 4061, the discharge hole 4048, the guide member 4063, the rear wall of the cover member 4064, and also to the hole edge of the outlet hole 4013 that is below the ultraviolet light irradiation device. Furthermore, ultraviolet light can be irradiated to the inside of the cup 4000C that is disposed on the stage 4071 and below the ultraviolet light irradiation device and also to the inside of the outer drain pan 4072.

[Summary of Configuration, Operations and Effects]

[0314] In the ice dispenser 4501 according to the twenty-first embodiment, the housing 4010 includes the outlet hole 4013 that is communicated with the discharge hole 4048 and disposed below the discharge hole 4048. The ice pieces 40IC that are discharged through the discharge hole 4048 are dispensed outside the housing 4010 through the outlet hole 4013. The ultraviolet light irradiation device 4580 is mounted at the position in the housing 4010 so as to be in front of the discharge hole 4048 and above the outlet hole 4013 and irradiate ultraviolet light rearward and downward.

[0315] According to the above configuration, ultraviolet light can be irradiated to both the discharge hole 4048, which is positioned behind the ultraviolet light irradiation device 4580, and the outlet hole 4013, which is positioned below the ultraviolet light irradiation device 4580. When the shutter 4061 is open, ultraviolet light can be irradiated to an edge section of the bottom of the ice tank 4040 through the discharge hole 4048. Therefore, drink or food can be provided with higher safety by sterilizing the ice pieces 40IC that pass through the holes with keeping portions adjacent to the irradiated portions clean. Furthermore, ultraviolet light can be irradiated to the cup 4000C that is disposed below the outlet hole 4013 and receives the ice pieces 40IC and the ice pieces 40IC that are received in the cup 4000C. Thus, the cup 4000C and the ice pieces 40IC therein can be sterilized. With a configuration that ultraviolet light is irradiated at a low irradiation intensity even in the standby state, ultraviolet light can be irradiated to the stage 4071 and the inside of the outer drain pan 4072 that is disposed under the stage 4071. Thus, the stage 4071 and the outer drain pan 4072 can be sterilized. As a result, with one ultraviolet light

irradiation device 4580, a wide area can be sterilized and safe ice pieces 40IC can be provided with keeping the ice dispenser 4501 clean. In this embodiment, ultraviolet light is irradiated to a space between the upper protrusion portion 4011U and the lower protrusion portion 4011L. With using the ultraviolet light irradiation device 4580 that irradiates ultraviolet light and visible light, a user can check the ultraviolet light irradiation area.

<Twenty-second Embodiment>

[0316] A twenty-second embodiment will be described with reference to FIG. 57. In the twenty-second embodiment, a configuration and a mount position of an ultraviolet light irradiation device 4680 differ from those of the ultraviolet light irradiation device 4080 of the seventeenth embodiment. Other configurations of an ice dispenser 4601 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4680]

[0317] The ultraviolet light irradiation device 4680 according to this embodiment includes ultraviolet light emission diodes having high directivity and emits ultraviolet light and visible light. In this embodiment, as illustrated in FIG. 57, the ultraviolet light irradiation device 4680 is mounted on a bottom surface of the outer drain pan 4072. The ultraviolet light irradiation device 4680 can emit ultraviolet light upward. As illustrated by arrows with dashed lines in FIG. 57, ultraviolet light can be irradiated to the inside of the outer drain pan 4072, the surroundings of the outlet hole 4013, a distal end portion of the water supply pipe 4017 held by the pipe holder 4064A, the cover member 4064, and a lower end portion of the guide member 4063.

[Summary of Configuration, Operations and Effects]

[0318] In the ice dispenser 4601 according to the twenty-second embodiment, the housing 4010 includes the outlet hole 4013 that is communicated with the discharge hole 4048. The ice pieces 40IC that are discharged through the discharge hole 4048 are dispensed outside the housing 4010 through the outlet hole 4013. The stage 4071 is disposed below the outlet hole 4013 and the cup 4000C for receiving the ice pieces 40IC that are dispensed through the outlet hole 4013 is placed on the stage 4071. The outer drain pan 4072 is disposed under the stage 4071 and receives the ice pieces 40IC that are not received by the cup 4000C. The ultraviolet light irradiation device 4680 is mounted on the inner surface of the bottom of the outer drain pan 4072 so as to emit ultraviolet light upward.

[0319] According to the above configuration, with the ultraviolet light irradiation device 4680 being disposed far away from the outlet hole 4013, ultraviolet light can be irradiated by one ultraviolet light irradiation device

4680 to a wide area ranging from the outlet hole 4013 that is above the outer drain pan to the discharge cavity of the ice pieces 401C that is continuous upward from the outlet hole 4013. Furthermore, ultraviolet light can be irradiated to purified water dispensed with the ice pieces 401C and an opening edge of the water supply pipe 4017 from which the purified water is discharged. When the cup 4000C is set and the ice pieces 401C are dispensed, some of the ice pieces 401C that are dispensed may not be received by the cup 4000C and may be received by the outer drain pan 4072. The ice pieces received by the outer drain pan 4072 are irradiated with ultraviolet light having high intensity to perform sterilization. This suppresses bacterial growth in the outer drain pan 4072 and also in the inner drain pan 4073. In this embodiment, with using ultraviolet light emission diodes having high directivity as the ultraviolet light irradiation device 4680, the ultraviolet light irradiation area is less likely to become too large. In this embodiment, ultraviolet light is irradiated to a space between the upper protrusion portion 4011U and the lower protrusion portion 4011L. With using the ultraviolet light irradiation device 4680 that irradiates ultraviolet light and visible light, a user can check the ultraviolet light irradiation area.

<Twenty-third Embodiment>

[0320] A twenty-third embodiment will be described with reference to FIG. 58. In the twenty-third embodiment, a mount position of an ultraviolet light irradiation device 4780 differs from that of the ultraviolet light irradiation device 4080 of the seventeenth embodiment. Other configurations of an ice dispenser 4701 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4780]

[0321] The ultraviolet light irradiation device 4780 according to this embodiment includes ultraviolet light emission diodes having high directivity. In this embodiment, as illustrated in FIG. 58, the ultraviolet light irradiation device 4780 is mounted on a front side surface of the outer drain pan 4072 so as to be opposite a basal end portion of the cavity 4072B that is communicated with the inner drain pan 4073. The ultraviolet light irradiation device 4780 can emit ultraviolet light rearward. As illustrated by arrows with dashed lines in FIG. 58, ultraviolet light can be irradiated from the inside of the outer drain pan 4072 to the inside of the cavity 4072B.

[Summary of Configuration, Operations and Effects]

[0322] In the ice dispenser 4701 according to the fifty-second embodiment, the housing 4010 includes the outlet hole 4013 in the front surface of the housing 4010. The outlet hole 4013 is communicated with the discharge hole 4048. The ice pieces 401C that are discharged

through the discharge hole 4048 are dispensed outside the housing 4010 through the outlet hole 4013. The stage 4071 is disposed below the outlet hole 4013 and the cup 4000C for receiving the ice pieces 401C that are dispensed through the outlet hole 4013 is placed on the stage 4071. The outer drain pan 4072 is disposed under the stage 4071 and receives the ice pieces 401C that are not received by the cup 4000C. The inner drain pan 4073 is disposed behind the outer drain pan 4072 in the housing 4010 and is communicated with the outer drain pan 4072. The ultraviolet light irradiation device 4780 is mounted on the front side surface of the outer drain pan 4072 so as to emit ultraviolet light rearward.

[0323] If bacteria grow in the outer drain pan 4072 or in the inner drain pan 4073, slimy substances may be created and a water discharge outlet and the water discharge pipe 4074 through which drain water is discharged outside the ice dispenser 4701 are clogged with the slimy substances. This may cause leaking of water or electric leakage. With the above configuration, not only the outer drain pan 4072 but also a cavity 4972B, which connects the outer drain pan 4072 and the inner drain pan 4073, and the inner drain pan 4073 can be irradiated with ultraviolet light. As a result, bacteria growth is less likely to be caused in the outer drain pan 4072 and the inner drain pan 4073 and the ice dispenser 4701 can be kept clean and troubles in water discharge can be reduced. In this embodiment, since ultraviolet light emitting diodes having high directivity are used as the ultraviolet light irradiation device 4780, ultraviolet light can be surely irradiated to the inside of the cavity 4072B.

<Twenty-fourth Embodiment>

[0324] A twenty-fourth embodiment will be described with reference to FIG. 59. In the twenty-fourth embodiment, a mount position of an ultraviolet light irradiation device 4880 differs from that of the ultraviolet light irradiation device 4080 of the seventeenth embodiment. Other configurations of an ice dispenser 4801 (the ice making machine) are similar to those of the ice dispenser 4001 of the seventeenth embodiment.

[Ultraviolet Light Irradiation Device 4880]

[0325] In this embodiment, as illustrated in FIG. 59, the ultraviolet light irradiation device 4880 is mounted above the cavity 4072B that connects the outer drain pan 4072 and the inner drain pan 4073 in the housing 4010. The ultraviolet light irradiation device 4880 can emit ultraviolet light downward. As illustrated by arrows with dashed lines in FIG. 59, ultraviolet light can be irradiated to the cavity 4072B and the inside of the inner drain pan 4073.

[Summary of Configuration, Operations and Effects]

[0326] In the ice dispenser 4801 according to the twenty-fourth embodiment, the housing 4010 includes the out-

let hole 4013 in the front surface of the housing 4010. The outlet hole 4013 is communicated with the discharge hole 4048. The ice pieces 401C that are discharged through the discharge hole 4048 are dispensed outside the housing 4010 through the outlet hole 4013. The stage 4071 is disposed below the outlet hole 4013 and the cup 4000C for receiving the ice pieces 401C that are dispensed through the outlet hole 4013 is placed on the stage 4071. The outer drain pan 4072 is disposed under the stage 4071 and receives the ice pieces 401C that are not received by the cup 4000C. The inner drain pan 4073 is disposed in a lower section of the housing 4010. The cavity 4072B that connects the outer drain pan 4072 and the inner drain pan 4073 is disposed in the housing 4010. The ultraviolet light irradiation device 4880 is mounted above the cavity 4072B so as to emit ultraviolet light downward.

[0327] According to the above configuration, by irradiating ultraviolet light intensively to the cavity 4072B, drain water flowing from the outer drain pan 4072 to the inner drain pan 4073 can be surely sterilized. With a configuration that ultraviolet light can be irradiated to the inside of the inner drain pan 4073 by the ultraviolet light irradiation device 4880, the inside of the inner drain pan 4073 can be sterilized.

<Other Embodiments>

[0328] The technology described herein is not limited to the embodiments described above with reference to the drawings. The following embodiments may be included in the technical scope. The technology described herein may be modified within the technical scope.

(1) Other than the above-described embodiments, the configurations of the UV sterilization device may be modified as appropriate. For instance, the UV sterilization device may be disposed directly below the recovery hole that is continuous from the recovery cavity and may be configured to emit ultraviolet light upward from the bottom. In such a configuration, the control section may be configured to discharge ice making water that remains in the ice storing section and contains concentrated bacteria and impurities before driving the pump device and to supply ice making water to the storing section.

(2) In the third modification, the ice making machine is configured such that a portion of the wall of the storing section can transmit visible light; however, the configuration of the ice making machine may not be limited to such a configuration. For instance, the ice making machine may be configured such that an entire wall of the storing section or a portion of the cover or an entire cover can transmit visible light. The ice making machine may include a light guide member that extends from the inside to the outside of the storing section and may be configured such that visible light that is irradiated from a visible light

irradiation portion to the light guide member can be seen from the outside of the ice making machine.

(3) In the above embodiments, the ice making machine is configured such that the float switch mounted on the cover detects a water level of the ice making water stored in the storing section; however, the configuration of the ice making machine may not be limited to such a configuration. For instance, the ice making machine may include a UV detection device, which detects ultraviolet light, on a cover. The UV detection device may detect ultraviolet light that reflects off the ice making water stored in the storing section such that the control section may determine the water level of the ice making water stored in the storing section.

(4) Other than the above embodiments, the position of the UV sterilization device may be altered as appropriate. In the fourth embodiment, the UV sterilization device is mounted on the upper wall 2251A; however, the UV sterilization device may be mounted on the lower wall 2251C. With such a configuration, the ice moving along the spout moves along the UV sterilization device and this improves the sterilization effects. Bacteria or dirt adhering to the UV sterilization device can be preferably washed away by the moving ice.

(5) In the fourth embodiment, the forming member 2223 includes the four dividing portions 2223A and four ice transfer cavities 2000P. However, the forming member may include six dividing portions and six ice transfer cavities. Each of the dividing portions may have a different size.

(6) Other than the above embodiments, the control process performed by the control section may be modified as appropriate. For instance, the control section may switch the UV sterilization device from OFF to ON when the ice made by the ice making section is started to be transferred from the discharge hole to the cavity. In such a control process, the control section may determine whether the ice is started to be transferred based on time that has passed after the activation of the compressor, temperature at the inlet or the outlet of the evaporator, and a current of the gear motor.

(7) In the above embodiments, the control device switches the irradiation amount of ultraviolet light from the ultraviolet light irradiation device between two modes of the HIGH mode and the LOW mode. As illustrated in FIG. 29, the target current value I_a can be determined freely according to the required irradiation amount of ultraviolet light. Therefore, the control device may be configured to switch the irradiation amount of ultraviolet light from the ultraviolet light irradiation device in any number of modes.

(8) In the above embodiments, the ultraviolet light irradiation device includes a deep ultraviolet rays UV-LED as the light source. However, the light source included in the ultraviolet light irradiation de-

vice is not limited to the deep ultraviolet rays UV-LED as long as the light source can vary the irradiation amount of ultraviolet light. Other types of UV-LED or a discharge UV lamp may be used as the light source.

(9) The control device that can vary the irradiation amount of ultraviolet light from the ultraviolet light irradiation device does not necessarily include the electronic circuit section described in the above embodiments but may include an electronic circuit performed with other PWM control, an ON and OFF cycle control at a relatively long interval (for example, from 0.1 seconds to 100 seconds), an electronic circuit performed with linear control using transistor elements, and an electronic circuit using resistance value changing means.

(10) In the above embodiments, the water amount sensor 3048 that detects a water level of water in the water tank 3041 is an ultrasonic sensor; however, the water amount sensor 3048 may not be limited to the ultrasonic sensor as long as the water amount sensor 3048 can detect a water level in the water tank 3041. For example, a float switch or an infrared sensor may be used. A water amount sensor that is suitable to a volume of the water tank 3041, required accuracy, and a cost can be used. With a float switch being used as the water amount sensor 3048, the distance d between the water amount sensor 3048 and the water surface can be linearly estimated with using following relations when determining a target current value I_a in the eighth embodiment.

at the time of low water level: $d = d_1 + d_2 \times t_c / T_c$

at the time of high water level: $d = d_1 + d_2 \times t_s / T_s$

In the formulae, d_1 represents a distance between the ultraviolet light source and the ice making highest water level and d_2 represents a distance between the ice making highest water level and the ice making lowest level. T_c represents a non-water supply time (for example, an arithmetic average value as a result of multiple measurements) necessary for the water level moving from the ice making highest water level to the ice making lowest water level by the ice making operation by the ice making machine 4601. t_c represents time that has passed after stopping of water supply (the closing of the water supply valve V_s). T_s represents a water supply time (for example, an arithmetic average value as a result of multiple measurements) necessary for the water level moving from the ice making lowest water level to the ice making highest water level by supplying water with the ice making operation by the ice making machine 4601. t_s represents time that has passed after starting of water supply (the opening of the water supply valve V_s).

(11) The ice making machine may have a combination of any of the above embodiments. For instance,

the configuration of the eleventh embodiment that the irradiation amount of ultraviolet light is determined with considering the distance between the light source of the ultraviolet light irradiation device and the water level may be used in determining target current values I_a in the HIGH mode control and the LOW mode control.

(12) In the above embodiments, the ice making machine includes the auger-type ice making mechanism and dispense ice; however, the present technology is not limited to such an ice making machine. The present technology may be used in various types of ice making machines such as ice making machines of a flow down type, a cell type, a drum type, and a water storage type. The present technology may be used for an ice dispenser that supplies drink such as water with ice and dispensers that dispense various kinds of drink or food such as a tea dispenser, a coffee server, and a soup server.

(13) In <Control Process 1-2> of the sixth embodiment, water in the water tank 3041 is consumed for making ice and water is periodically supplied while the freezing unit 3010 and the ice making unit 3020 are driven. Therefore, the water may stay in the water tank 3041 for a short time (for example, about one minute to fifteen minutes) depending on a relation between the volume of the water tank 3041 and the ice making speed of the ice making unit 3020. In such a case, even if the water supply valve V_s is closed, a current control section 4121 may set the target current value of the ultraviolet light irradiation to the value of the LOW mode while the freezing unit 3010 and the ice making unit 3020 are driven.

(14) In the above embodiments, the shutter 4061 is linked with the touch switch 4067 and the lever switch 4065 and the switches are configured as the shutter detection means; however, the present technology is not limited to such configurations. For instance, the shutter may be configured to close the discharge hole if a predefined time passes after opening the discharge hole. The shutter may be configured to close the discharge hole if a predefined amount of drink or food is dispensed after opening the discharge hole. The shutter may be connected to the control section and opened and closed in response to a signal outputted by the control section to the shutter. The control section may determine that the shutter is opened or closed by outputting such a signal. An optical sensor or a weight sensor that detect the opening and closing of the shutter or the dispensing state of the drink or food may be used as shutter detection means.

(15) In the eighteenth embodiment and other embodiments including the outlet hole cover, the outlet hole cover 4250 is opened manually and the cover opening and closing detection sensor 4251 detects an open state and a closed state of the outlet hole cover 4250. However, the present technology is not

necessarily limited to such a configuration. For instance, the control section may be connected to an actuator that opens and closes the outlet hole cover. The outlet hole cover may be opened and closed according to a signal outputted by the control section to the actuator. The control section may determine that the outlet hole cover is opened or closed if outputting such a signal.

(16) The dispenser (the ice making machine) may be configured by combining some of the configurations of the above embodiments. For instance, the configuration of the twenty-first embodiment or the twenty-second embodiment in which ultraviolet light is irradiated outside the housing may include the outlet hole cover of the eighteenth embodiment. In such a configuration, the irradiation intensity of ultraviolet light may be controlled with considering the open state or the closed state of the outlet hole cover as is in the eighteenth embodiment. Accordingly, safety of users can be effectively increased.

(17) The dispenser may include some of the ultraviolet light irradiation devices described in the above embodiments. For instance, the dispenser may include an ultraviolet light irradiation device that is mounted at a position so as to irradiate ultraviolet light to a wide range of the discharge cavity of drink or food like the ultraviolet light irradiation device 4580 of the twenty-first embodiment and an ultraviolet light irradiation device that is mounted at a position so as to irradiate ultraviolet light to the discharge mechanism including a drain pan like the ultraviolet light irradiation device 4780 of the twenty-third embodiment. With such a configuration, drink or food having high safety can be provided and good sanitation can be kept in the dispenser.

EXPLANATION OF SYMBOLS

[0329] 10...ice making machine, 20...ice making section, 32... pump device (pump), 33... circulation mechanism, 60, 160, 260, 360, 460, 560, 660...watertank (tank), 61, 162, 261, 361, 461, 561, 661... storing section, 61A, 461A... outlet section, 62, 162, 362...discharge section, 65...protruded portion, 65U...top portion, 66T...trap, 68268, 568, 668D, 668E, 668F... introduction section, 80...control section, 90, 490, 590, 690D, 690E, 690F...UV sterilization device, 93...trap-side UV sterilization device, 2010, 2200, 2600, 2700...ice making machine, 2020, 2220, 2420, 2520...ice making section, 2023A, 2223A...dividing portion, 2027, 2227, 2527... exit opening section, 2028, 2228, 2428, 2528...rotary member (cutter), 2050, 2250, 2350, 2450, 2550, 2650...transfer cavity, 2052R1...opening, 2070, 2270, 2770...ice tank, 2070A, 2070B, 2070C, 2270A, 2770A...wall, 2675...ice detection device, 2073...UV sterilization device, 3001, 3201, 3301, 3401, 3501, 3601, 3701, 3801, 31001, 31101... ice making machine, 3005...ice making section, 3010...freezing unit, 3020...ice making unit,

3025A...spout, 3025B...chute, 3030...ice storing section, 3031...stocker, 3035, 3235...ice amount sensor, 3036...agitator, 3040...water supply and discharge mechanism, 3041... water tank, 3048... water amount sensor, 3050, 3250, 3350, 3450, 3750, 3850, 3950, 31150...ultraviolet light irradiation device, 3100...control device, 3110...ice making operation control section, 3120...ultraviolet light irradiation control section, 3121, 3221, 3321, 3421, 3521, 3621, 3721, 31121... current control section, 3122...electronic circuit section, S1...first water supply cavity, S2... second water supply cavity, D1...first water discharge cavity, D11...returning cavity, D12...branched discharge cavity, D2... second water discharge cavity, D3... third water discharge cavity, D4... water discharge cavity, 4001, 3201, 4301, 4401, 4501, 4601, 4701, 4801... ice dispenser (one example of a dispenser as the ice making machine), 4010, 4210...housing, 4011L...lower protrusion portion, 4011U...upper protrusion portion, 4013... outlet hole, 4020...freezing device, 4030...ice making mechanism, 4040...ice tank (one example of the storing section), 4041... tank body, 4047... duckboard (one example of a drainer), 4048...discharge hole, 4060...dispense mechanism, 4061...shutter, 4062...solenoid device, 4063...guide member, 4064...cover member, 4064A...pipe holder, 4065...lever switch (another example of shutter detection means), 4067...touch switch (one example of the shutter detection means, 4070...water discharge mechanism, 4071... stage, 4072... outer drain pan, 4072A...step portion, 4072B ... cavity, 4073...inner drain pan, 4074... water discharge pipe, 4080, 4280, 4380, 4480, 4580, 4680, 4780, 4880...ultraviolet light irradiation device, 4090, 4290... control section, 4250... outlet hole cover, 4251... cover opening and closing detection sensor (one example of cover detection means), 4000C...cup (one example of a container), 401C...ice pieces (one example of drink or food)

Claims

1. An ice making machine comprising:

a tank including an introduction section via which water flows into the tank and an outlet section via which the water flows out from the tank, the tank storing the water therein;
an ice making section configured to freeze the water that flows out via the outlet section and make ice; and
a UV sterilization device irradiating ultraviolet light to the water and sterilize the water, wherein the UV sterilization device is disposed such that an ultraviolet light irradiation range of the UV sterilization device includes at least a flowing path of the water that flows into the tank via the introduction section.

2. The ice making machine according to claim 1, wherein

the tank includes a storing section storing the water and a discharge section discharging water that overflows from the storing section to outside of the storing section, and the discharge section is configured not to block ultraviolet light irradiated by the UV sterilization device toward the storing section.

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3. The ice making machine according to claim 1 or claim 2, wherein

the tank includes a bottom portion including a bottom surface, the outlet section is included in the bottom portion, the bottom portion is inclined downward as it extends toward the outlet section, and the UV sterilization device is mounted on a portion of the bottom portion adjacent to the outlet section.

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4. The ice making machine according to any one of claims 1 to 3, wherein

the tank includes a protruded portion that protrudes inward, and the protruded portion has a top portion that is opposite the introduction section and has a tapered shape.

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5. The ice making machine according to any one of claims 1 to 4, wherein

the introduction section includes an introduction opening that opens inside the tank and a flow cavity in which water from outside of the tank flows toward the introduction opening, and the flow cavity is bent at a portion adjacent to the introduction opening.

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6. The ice making machine according to any one of claims 1 to 5 further comprising:

a circulation mechanism with which water flowing out from the outlet section into the ice making section via a supply cavity is transferred to the tank again via a cavity that is different from the supply cavity by driving by a pump; and a control section configured to control driving of the pump according to ultraviolet light irradiation by the UV sterilization device.

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7. The ice making machine according to any one of claims 1 to 6 further comprising:

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a visible light irradiation device emitting visible light according to ultraviolet light irradiation by the UV sterilization device; and a visible check portion with which the visible light emitted by the visible light irradiation device can be seen.

8. The ice making machine according to any one of claims 1 to 7, wherein

the tank includes a storing section storing the water and a discharge section discharging water that overflows from the storing section to outside of the storing section, the discharge section includes a trap that temporarily stores the water discharged via the discharge section, and a trap-side UV sterilization device that irradiates ultraviolet light to water and sterilizes the water is disposed in the trap.

9. An ice making machine comprising:

an ice making section configured to freeze water and make ice; an ice tank storing the ice therein; a transfer cavity that extends from the ice making section to the ice tank and in which the ice moves from the ice making section into the ice tank; and a UV sterilization device irradiating ultraviolet light to the ice and sterilize the ice, wherein the UV sterilization device is disposed such that an ultraviolet light irradiation range of the UV sterilization device includes at least a moving path of the ice that moves along the transfer cavity.

10. The ice making machine according to claim 9, wherein

the transfer cavity includes an opening that opens toward inside of the ice tank, and the UV sterilization device is arranged in the ice tank so as to be opposite the opening.

11. The ice making machine according to claim 9 or claim 10, wherein

the ice tank includes a wall having an inner surface portion that reflects ultraviolet light, and the UV sterilization device is disposed such that the ultraviolet light irradiation range includes the inner surface portion of the ice tank.

12. The ice making machine according to claim 9, wherein

- the ice making section includes an exit opening section that includes an opening through which produced ice made by the ice making section exits to the transfer cavity, and the UV sterilization device is disposed in the transfer cavity to be opposite the exit opening section.
13. The ice making machine according to claim 12, wherein
- the exit opening section includes dividing portions that divides the produced ice, and the UV sterilization device is disposed in the transfer cavity to be opposite the dividing portions.
14. The ice making machine according to claim 12 or claim 13, wherein the exit opening section includes a cutter that cuts the produced ice with being rotated and a reflection member that is mounted on the cutter and reflects ultraviolet light.
15. The ice making machine according to any one of claims 12 to 14, wherein the transfer cavity includes a protruding portion between the UV sterilization device and the exit opening section and the protruding portion protrudes from an inner wall surface of the transfer cavity.
16. The ice making machine according to any one of claims 12 to 15, wherein
- the exit opening section includes a gas flow opening that is an opening of a gas flow cavity, and the UV sterilization device is disposed in the transfer cavity to be opposite the gas flow opening.
17. The ice making machine according to claim 9, wherein
- the transfer cavity includes an upper-bottom cavity that extends in an upper-bottom direction and in which the ice falls down from the ice making section into the ice tank, the UV sterilization device and a UV detection device are disposed in the upper-bottom cavity, and the UV detection device is disposed opposite the UV sterilization device and detects ultraviolet light.
18. The ice making machine according to claim 17, wherein
- the upper-bottom cavity includes a recessed
- portion that is recessed outward, and the UV sterilization device or the UV detection device is disposed in the recessed portion.
19. The ice making machine according to claim 17 or claim 18, wherein an ice detection device that detects the ice stored in the ice tank is disposed on the transfer cavity.
20. An ice making machine comprising:
- an ice making section configured to freeze ice making water and make ice;
an ice storing section storing the ice made by the ice making section; and
a water supply and discharge mechanism configured to supply and discharge the ice making water to and from at least the ice making section, wherein
at least one of the ice making section, the ice storing section, and the water supply and discharge mechanism includes an ultraviolet light irradiation device that emits ultraviolet light for sterilization and a control device configured to increase and decrease an irradiation amount of ultraviolet light from the ultraviolet light irradiation device.
21. The ice making machine according to claim 20, wherein
- the ultraviolet light irradiation device is included in the water supply and discharge mechanism, the water supply and discharge mechanism includes
- a water tank storing water to be supplied to the ice making section, and
a water supply valve that is disposed on a water supply cavity connecting an external source and the water storing tank and is configured to be opened and closed to supply and stop supplying water to the water tank from the external source, and
- the control device is configured to
- increase the irradiation amount from the ultraviolet light irradiation device when the water supply valve is opened, and
decrease the irradiation amount from the ultraviolet light irradiation device when the water supply valve is closed.
22. The ice making machine according to claim 21, wherein
- the ultraviolet light irradiation device is included

in the water supply and discharge mechanism, the water supply and discharge mechanism includes

a water tank storing water to be supplied to the ice making section, and
a water supply valve that is disposed on a water supply cavity connecting an external source and the water storing tank and is configured to be opened and closed to supply and stop supplying water to the water tank from the external source, and

the control device is configured to

drive the ultraviolet light irradiation device with a decreased irradiation amount of ultraviolet light, and
when the water supply valve is closed from an open state, increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device while the water supply valve is being closed.

- 23.** The ice making machine according to claim 21 or claim 22, wherein

the external source is configured to supply purified water purified through a purifier, and the control device is further configured to

decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the purifier does not reach an end of a life span, and
increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the purifier reaches the end of a life span.

- 24.** The ice making machine according to any one of claims 21 to 23, wherein the control device is configured to increase and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device according to an installation environment of the ice making machine.

- 25.** The ice making machine according to any one of claims 21 to 24, wherein the control device is configured to increase and decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device by controlling a current supplied to the ultraviolet light irradiation device with PWM control.

- 26.** The ice making machine according to any one of claims 21 to 25, wherein the control device further includes a timer measuring irradiation time of ultra-

violet light from the ultraviolet light irradiation device and is configured to increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device according to the irradiation time.

- 27.** The ice making machine according to any one of claims 21 to 26, wherein the control device further includes a timer measuring irradiation time of ultraviolet light from the ultraviolet light irradiation device and is configured to inform that the ultraviolet light irradiation device is close to an end of a life span at a predetermined timing before the ultraviolet light irradiation device reaches the end of a life span.

- 28.** The ice making machine according to claim 27, wherein the control device is configured to stop driving the ice making machine if the life span of the ultraviolet light irradiation device is not recovered when a predetermined time passes after informing that the ultraviolet light irradiation device is close to the end of the life span.

- 29.** The ice making machine according to any one of claims 21 to 28, wherein

the water supply and discharge mechanism includes

a water tank storing water to be supplied to the ice making section,
an ice making water supply cavity connecting the water tank and the ice making section and supplying the water in the water tank to the ice making section,
a returning cavity that is different from the ice making water supply cavity and connects the water tank and the ice making section and is for returning the water in the ice making section to the water tank, and
a liquid transfer pump disposed on the returning cavity and transferring the water in the returning cavity to the water tank,

in the water supply and discharge mechanism, the water tank, the ice making water supply cavity, and the returning cavity are configured as a circulation cavity and the ultraviolet light irradiation device is disposed on the circulation cavity, and

the control device is configured to

increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the liquid transfer pump is driven, and
decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the liquid transfer pump is not

- driven.
- 30.** The ice making machine according to any one of claims 21 to 29, wherein
- the water supply and discharge mechanism includes a water tank that stores water to be supplied to the ice making section, the water tank includes in an upper surface section
- a water amount sensor detecting a water level of the water stored in the water tank, and
- the ultraviolet light irradiation device irradiating ultraviolet light to the water stored in the water tank, and
- the control device is configured to
- decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the water level of the water stored in the water tank that is detected by the water amount sensor is relatively high, and
- increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the water level of the water stored in the water tank that is detected by the water amount sensor is relatively low.
- 31.** The ice making machine according to any one of claims 21 to 30, wherein
- the ice storing section is disposed upper than the ice making section and includes an agitating member agitating ice transferred from the ice making section and a driving section driving the agitating member,
- the ultraviolet light irradiation device is disposed in the ice storing section, and
- the control device is configured to
- increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the driving section drives the agitating member, and
- decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the driving section does not drive the agitating member.
- 32.** The ice making machine according to any one of claims 21 to 31, wherein
- the ice making section includes an ice making unit forming the ice and a freezing unit cooling
- the ice making unit to an ice making temperature,
- the ice storing section and the ice making unit are communicated with each other via an ice cavity via which ice formed by the ice making unit is transferred,
- the ultraviolet light irradiation device is disposed on the ice cavity, and
- the control device is configured to
- increase the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the freezing unit is driven, and
- decrease the irradiation amount of ultraviolet light from the ultraviolet light irradiation device when the freezing unit is not driven.
- 33.** The ice making machine according to any one of claims 21 to 32, wherein
- the ultraviolet light irradiation device is electrically connected to a visible light irradiation device in series and configured as an error detection circuit, and
- the visible light irradiation device is disposed at a position so as to be seen without taking apart the ice making machine.
- 34.** The ice making machine according to any one of claims 21 to 33, wherein
- the ultraviolet light irradiation device is electrically connected in series to a coil that is a portion of an a contact relay and a first resistor that has a relatively low resistance value so as to be configured as a first circuit,
- a contact point that is another portion of the a contact relay and becomes electrically conductive when a current flows to the coil, a second resistor that has a relatively high resistance value, and a visible light irradiation device are electrically connected in series and are configured as a second circuit, and
- the first circuit and the second circuit are disposed in parallel and configured as an error detection circuit.
- 35.** The ice making machine according to any one of claims 21 to 34, wherein
- the ultraviolet light irradiation device is electrically connected in series to a coil that is a portion of a b contact relay so as to be configured as a first circuit,
- an alarm and a contact point that is another portion of the b contact relay and becomes open when a current flows to the coil are electrically connected in series and are configured as a sec-

- ond circuit, and
the first circuit and the second circuit are disposed in parallel and configured as an error detection circuit.
36. The ice making machine according to any one of claims 21 to 35 further comprising a temperature sensor measuring a temperature of the ultraviolet light irradiation device, wherein the control device is configured to inform that the ultraviolet light irradiation device does not operate normally if a difference between an initial temperature when a current is started to be supplied to the ultraviolet light irradiation device and a temperature when a predetermined time passes after supplying of the current to the ultraviolet light irradiation device is smaller than a predetermined temperature difference.
37. An ice making machine comprising:
- a housing;
 - a storing section disposed in the housing and storing drink or food and including a discharge hole;
 - a shutter closing and opening the discharge hole;
 - shutter detection means detecting an open state and a closed state of the shutter;
 - an ultraviolet light irradiation device irradiating ultraviolet light to the drink or food discharged through the discharge hole for sterilization; and
 - a control section configured to control irradiation of ultraviolet light from the ultraviolet light irradiation device according to the open state and the closed state of the shutter that is detected by the shutter detection means.
38. The ice making machine according to claim 37, wherein the control section is configured to
- increase an irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if determining that the discharged hole is uncovered by the shutter, and
 - decrease the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if determining that the discharged hole is closed by the shutter after increasing the irradiation intensity.
39. The ice making machine according to one of claim 37 or claim 38, wherein
- the housing includes an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the hous-
- ing,
a stage is disposed below the outlet hole and a container for receiving the drink or food is disposed on the stage,
an outlet hole cover that is movable to cover and uncover a space between the outlet hole and the stage is mounted on the housing,
the ice making machine further comprises cover detection means detecting an open state and a closed state of the outlet hole cover, and
the control section is configured not to increase the irradiation intensity of ultraviolet light from the ultraviolet light irradiation device if the cover detection means does not detect that the outlet hole cover is closed.
40. The ice making machine according to claim 39, wherein
- the ultraviolet light irradiation device can emit ultraviolet light and visible light, and
the outlet hole cover includes a visible light transmission portion that blocks ultraviolet light and transmits visible light.
41. The ice making machine according to any one of claims 37 to 40, wherein
- a drainer that transmits ultraviolet light is disposed on a bottom surface portion of the storing section, and
the ultraviolet light irradiation device is disposed on a lower surface side of the drainer to emit ultraviolet light upward.
42. The ice making machine according to any one of claims 37 to 41, wherein
- the shutter is mounted to cover the discharge hole from a front side, and
the ultraviolet light irradiation device is disposed at a position in the housing so as to be opposite the shutter from a front side and to irradiate ultraviolet light rearward.
43. The ice making machine according to any one of claims 37 to 42, wherein
- the housing includes an outlet hole that is communicated with the discharge hole and is below the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, and
the ultraviolet light irradiation device is disposed at a position in the housing so as to be in front of the discharge hole and above the outlet hole and to irradiate ultraviolet light rearward and downward.

44. The ice making machine according to any one of claims 37 to 43, wherein

the housing includes on a front surface side

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an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container, and

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the ultraviolet light irradiation device is disposed on a bottom surface of the outer drain pan so as to emit ultraviolet light upward.

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45. The ice making machine according to any one of claims 37 to 44, wherein

the housing includes on a front surface side

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an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container,

30

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the housing includes therein an inner drain pan that is disposed behind the outer drain pan and communicated with the outer drain pan, and the ultraviolet light irradiation device is disposed on a front side surface of the outer drain pan so as to emit ultraviolet light rearward.

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46. The ice making machine according to any one of claims 37 to 45, wherein

45

the housing includes on a front surface side

an outlet hole that is communicated with the discharge hole and through which the drink or food discharged through the discharge hole is dispensed outside the housing, a stage that is disposed below the outlet hole and on which a container for receiving the drink or food is disposed, and an outer drain pan that is disposed under the stage and receives drink or food that is not received by the container,

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the housing includes therein an inner drain pan that is disposed in a lower section of the housing and a cavity that connects the outer drain pan and the inner drain pan, and

the ultraviolet light irradiation device is disposed above the cavity so as to emit ultraviolet light downward.

FIG.1

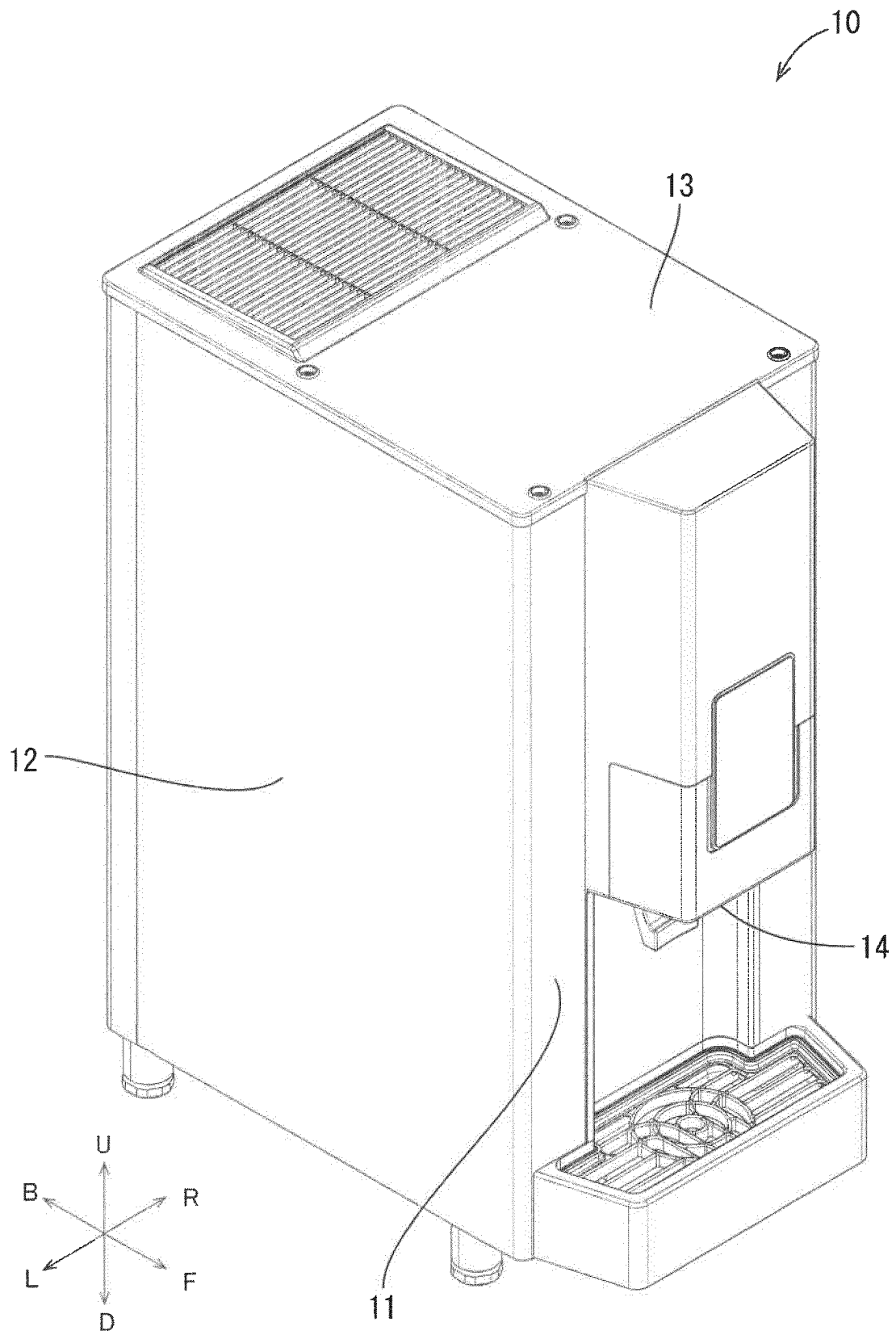


FIG.3

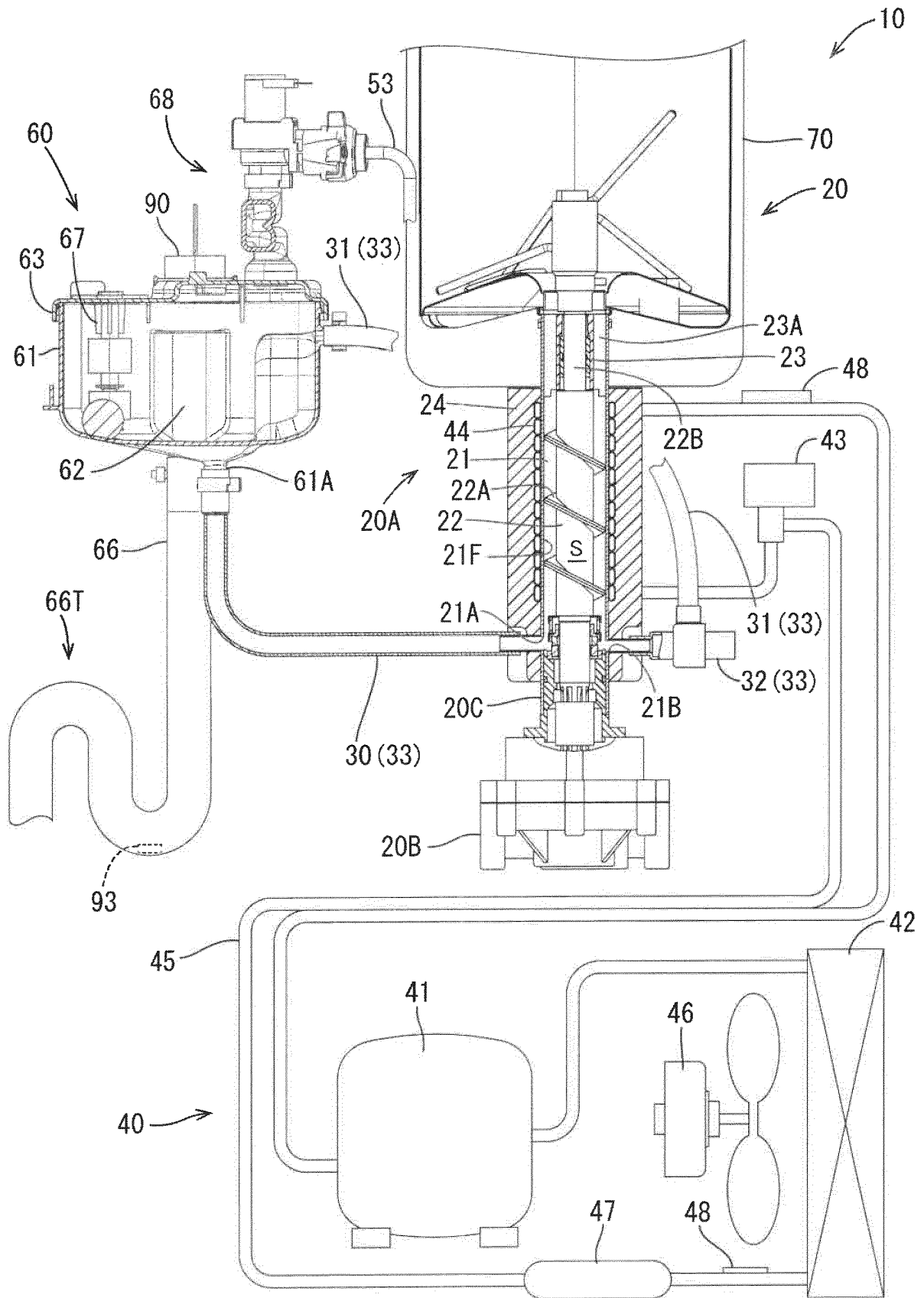


FIG.4

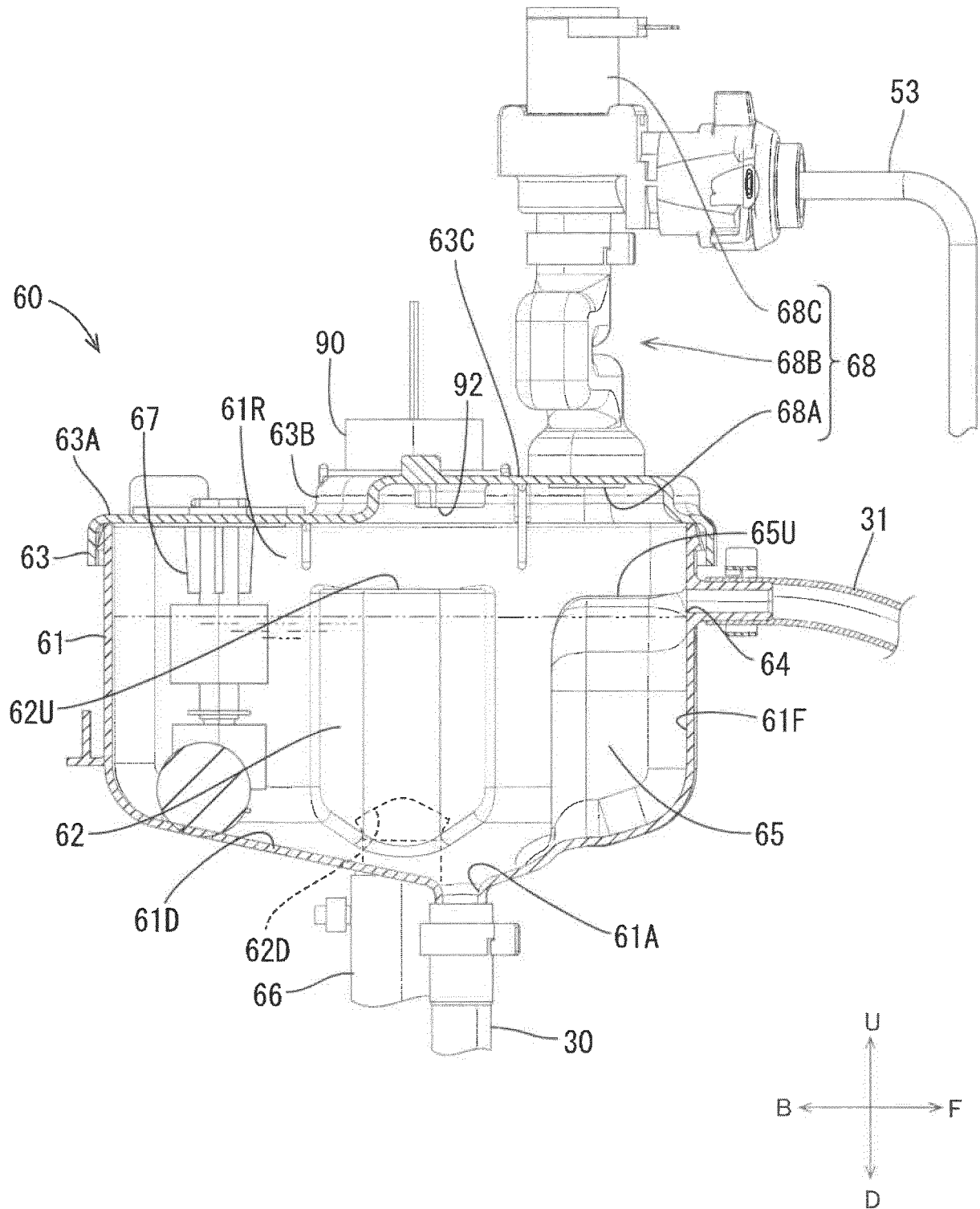
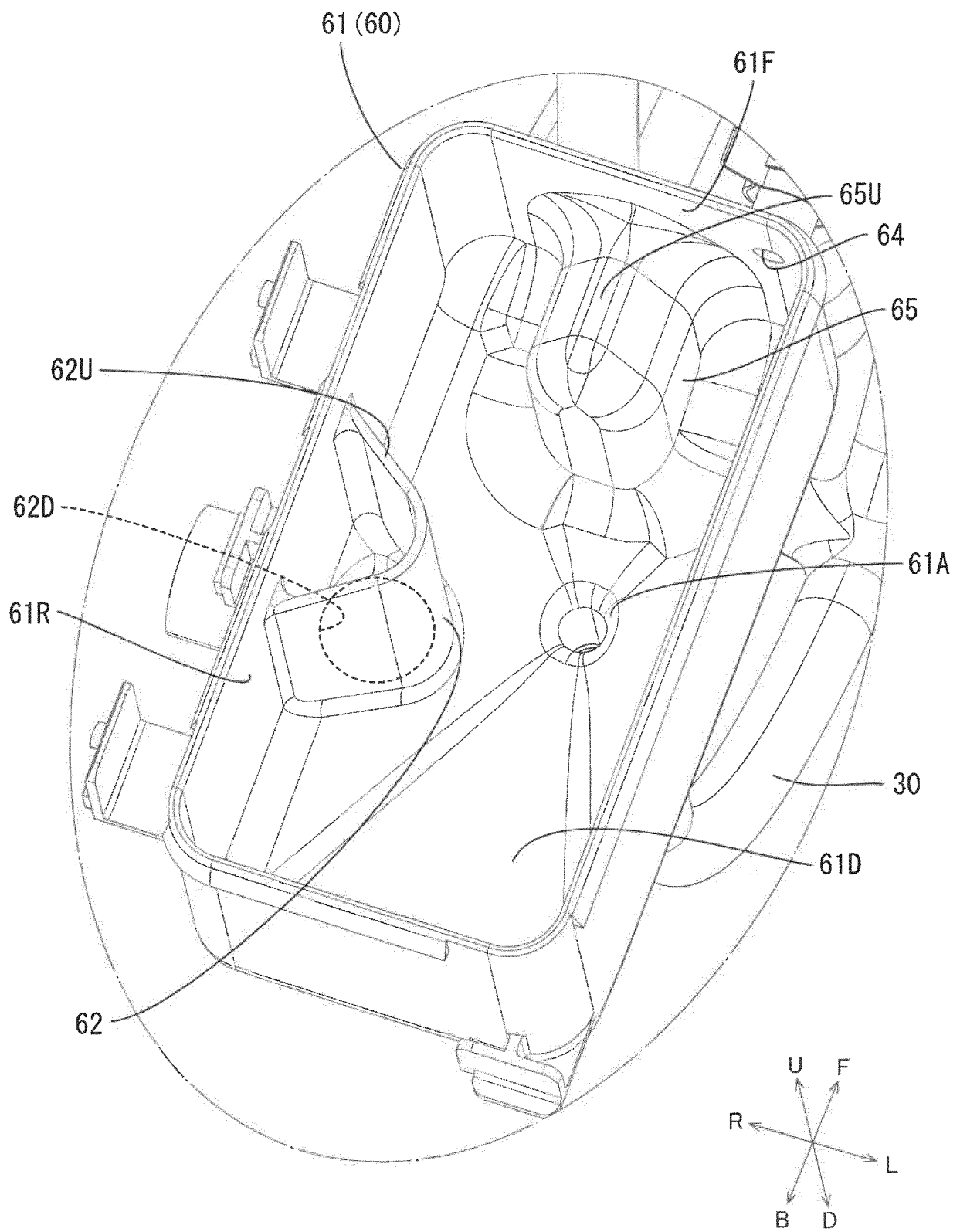
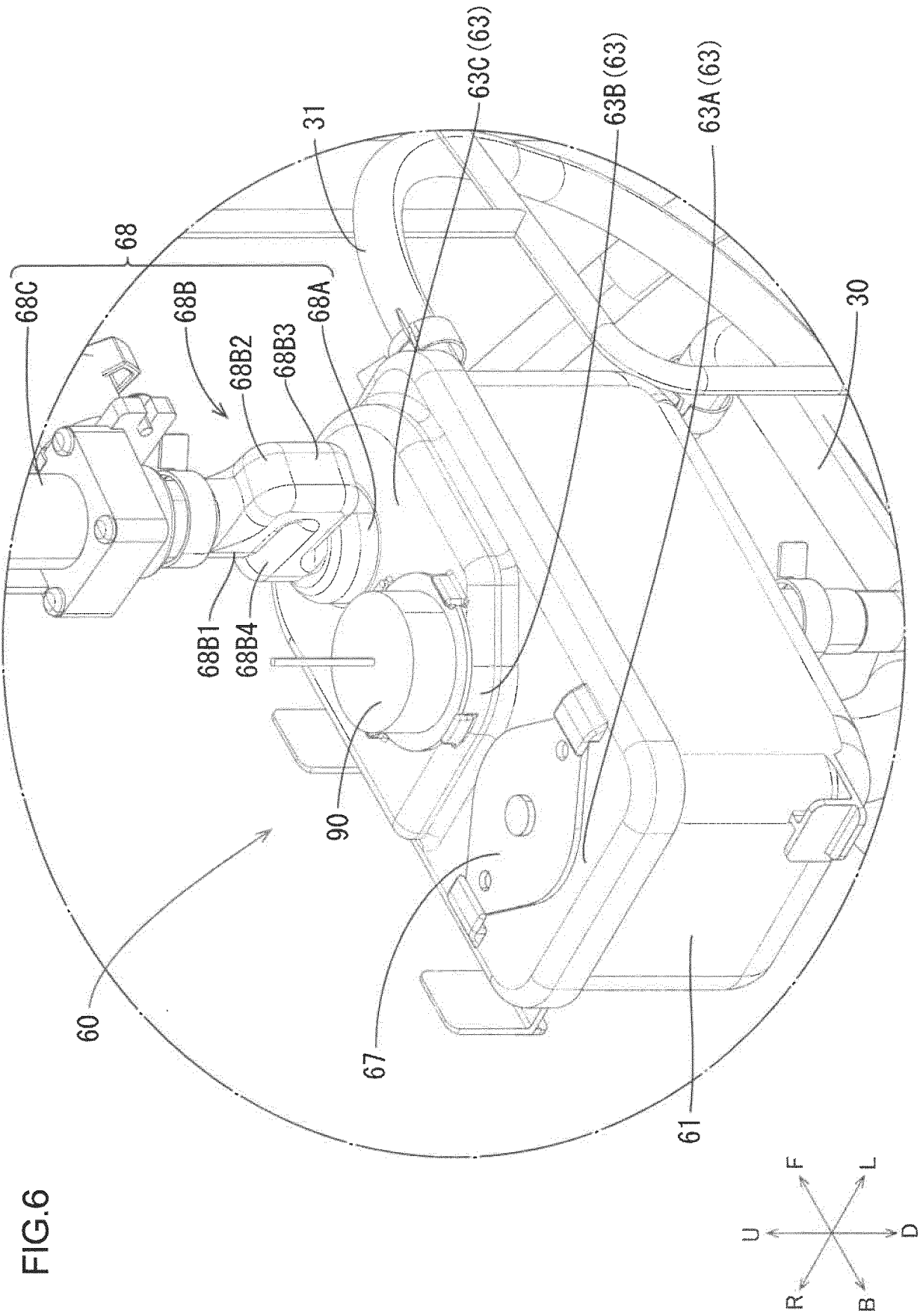


FIG.5





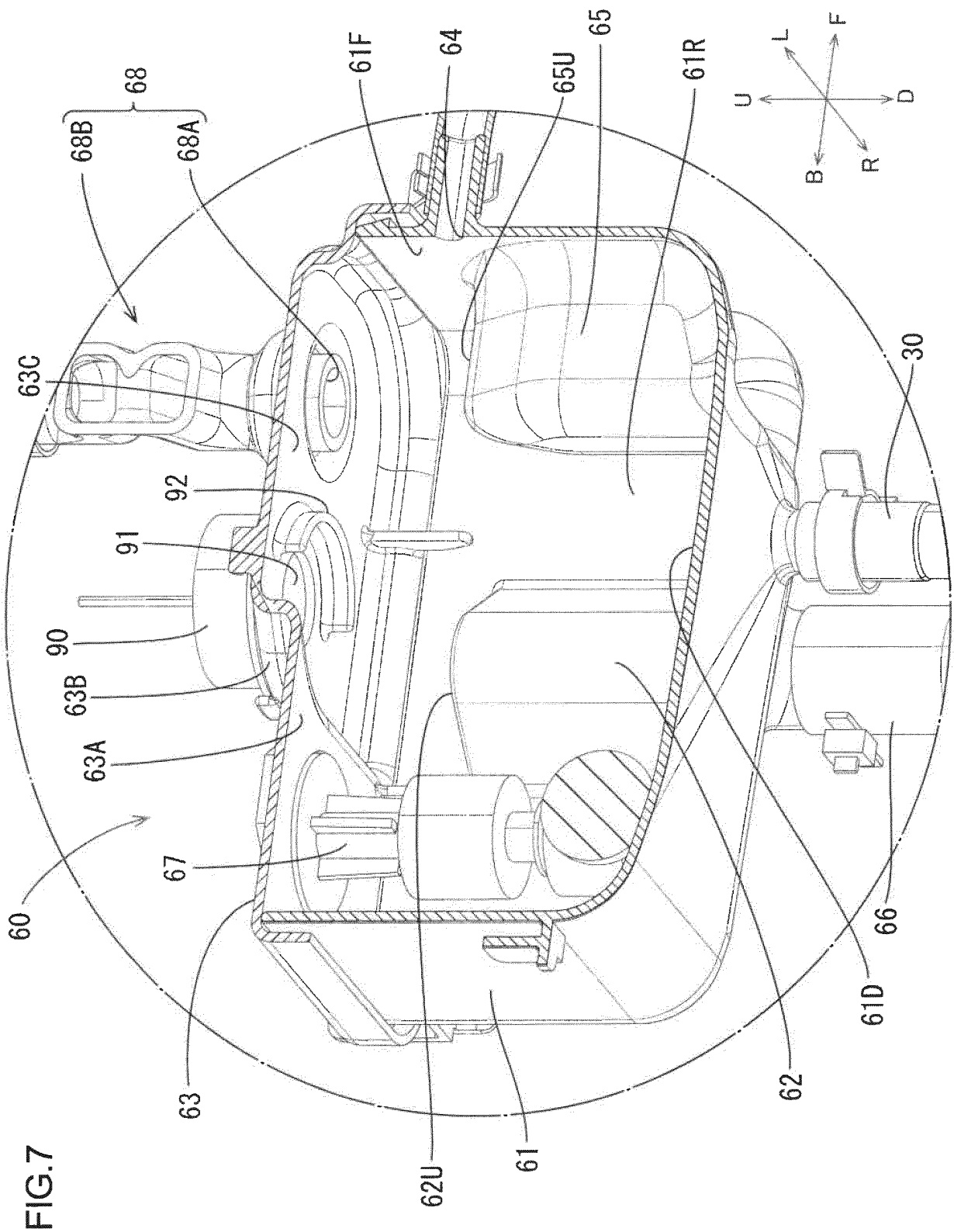


FIG.8

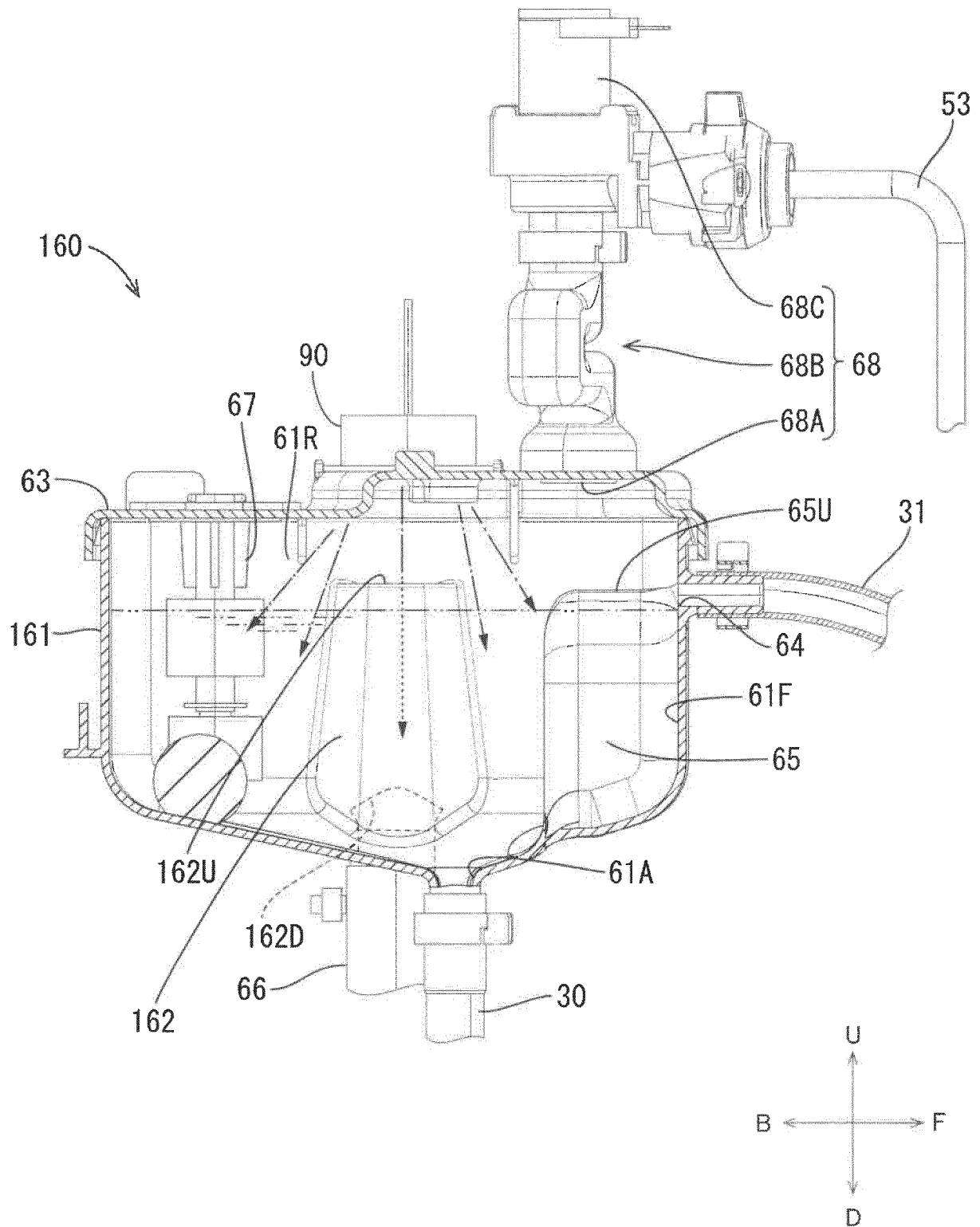


FIG.9

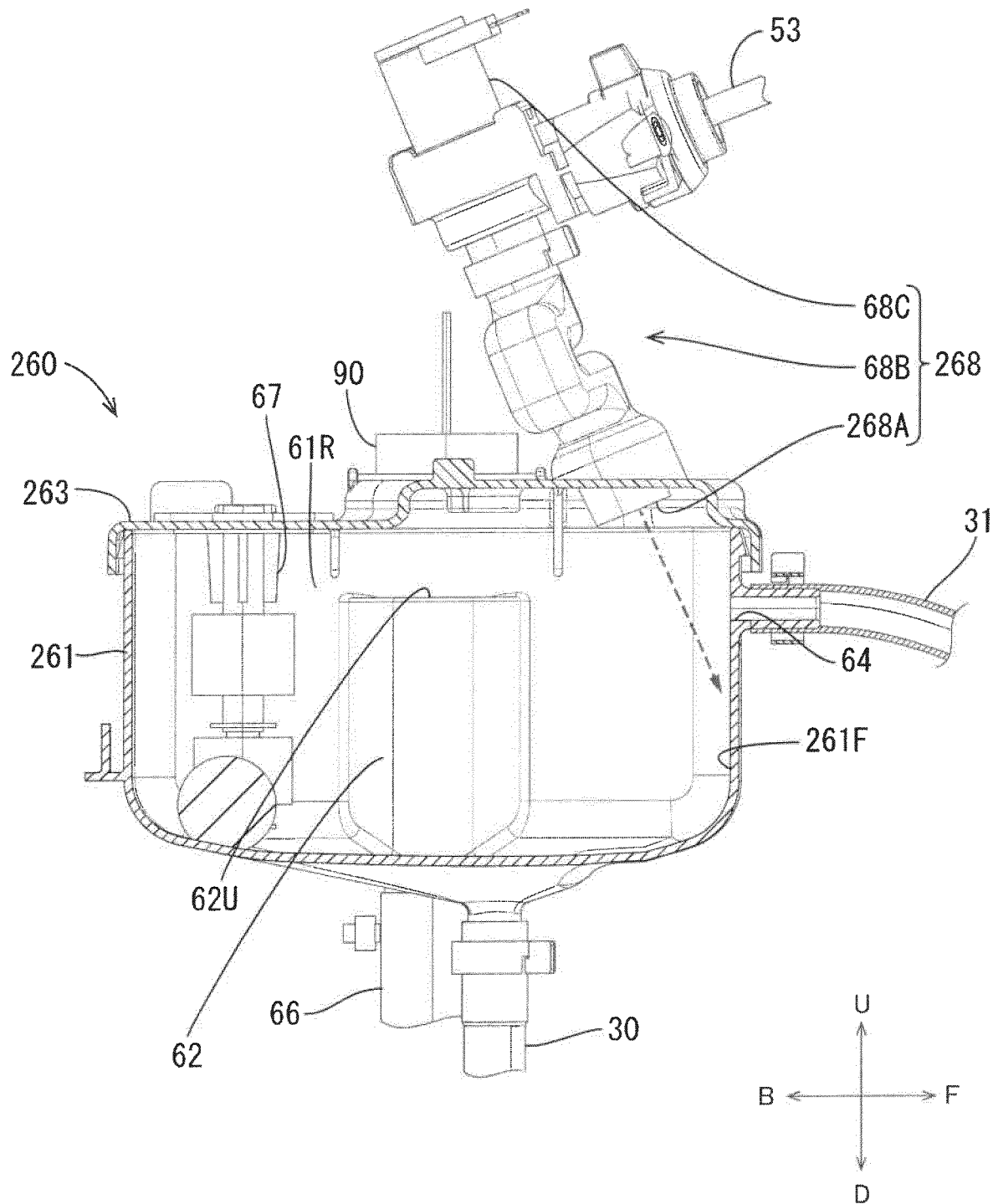


FIG.10

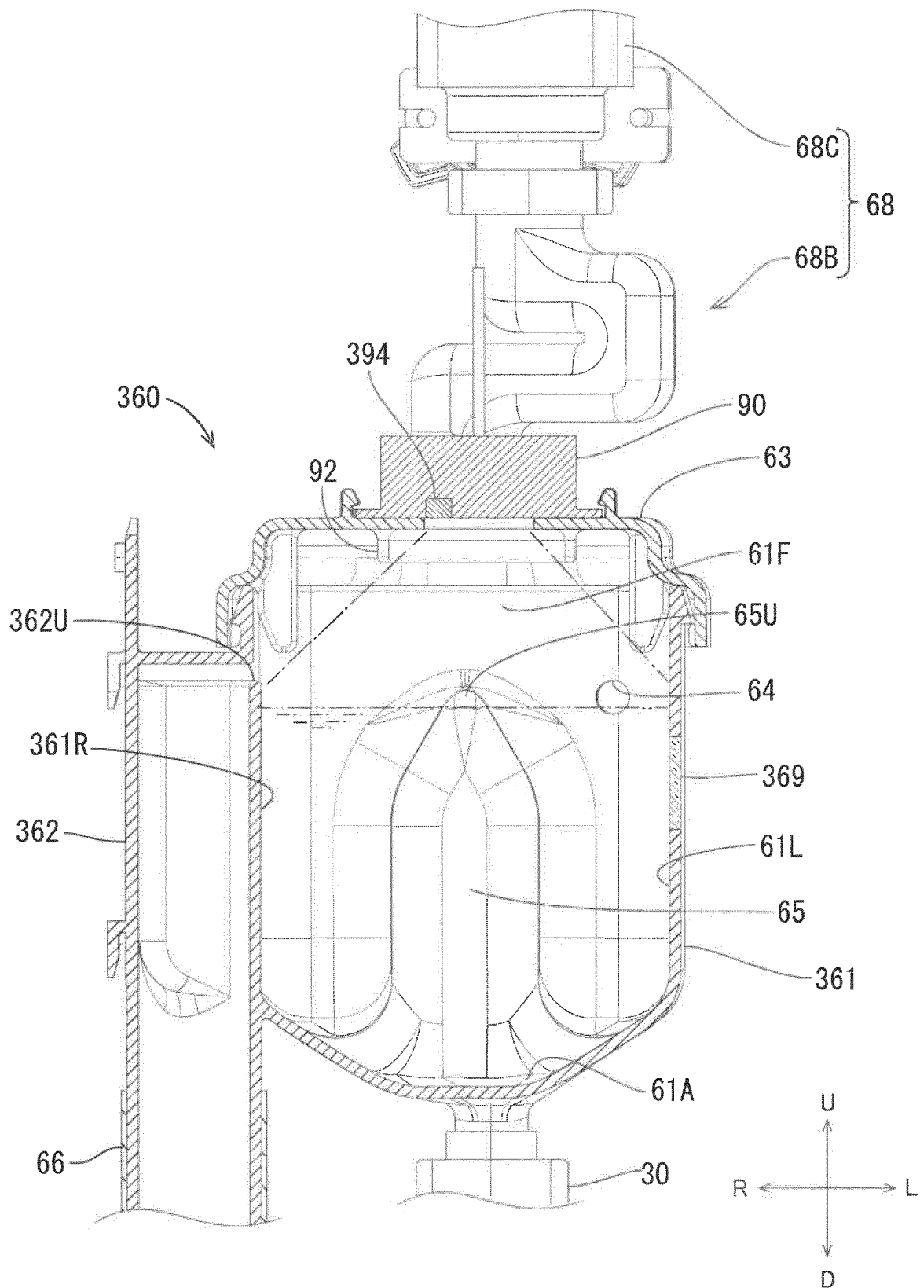


FIG.12

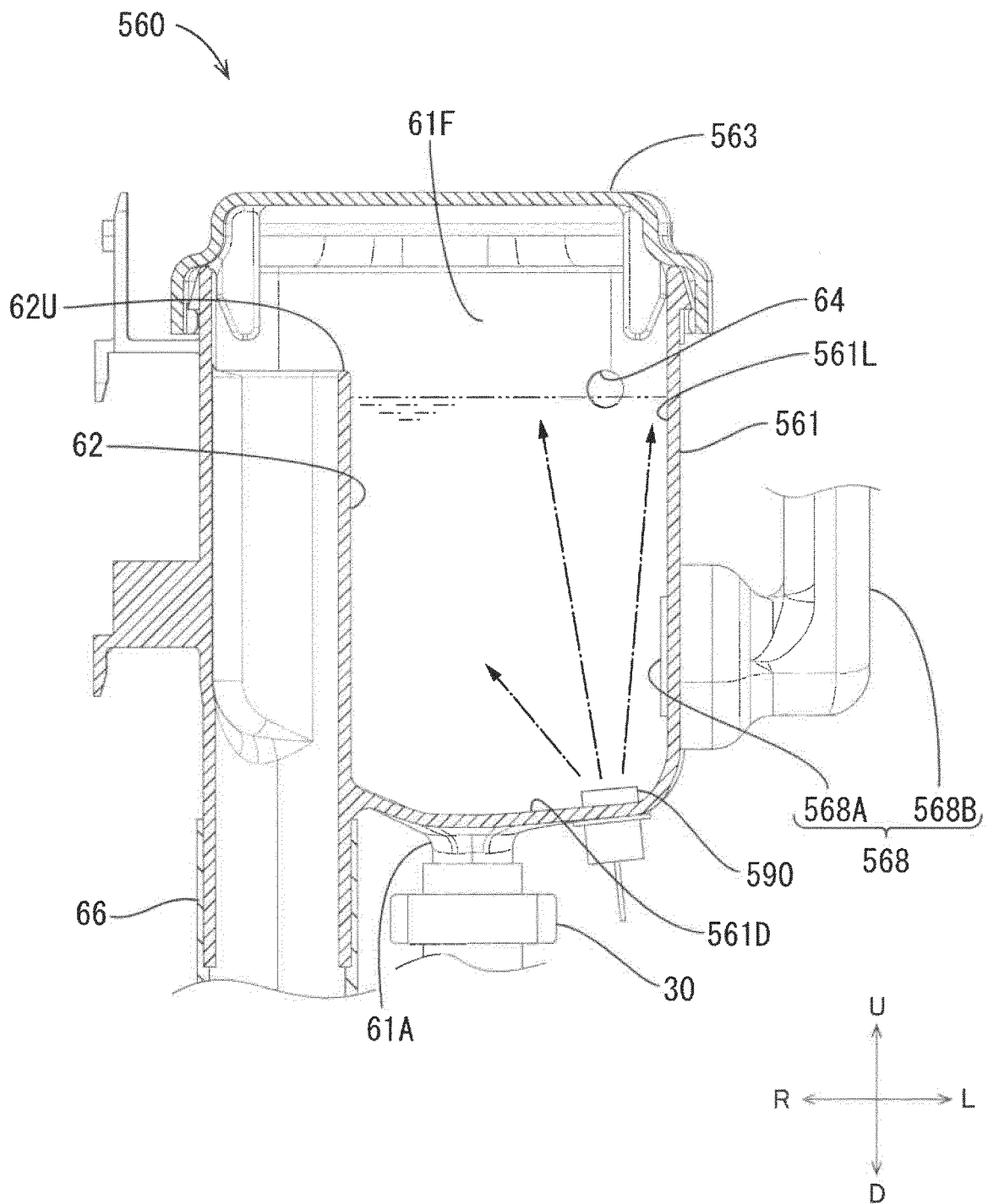


FIG.13

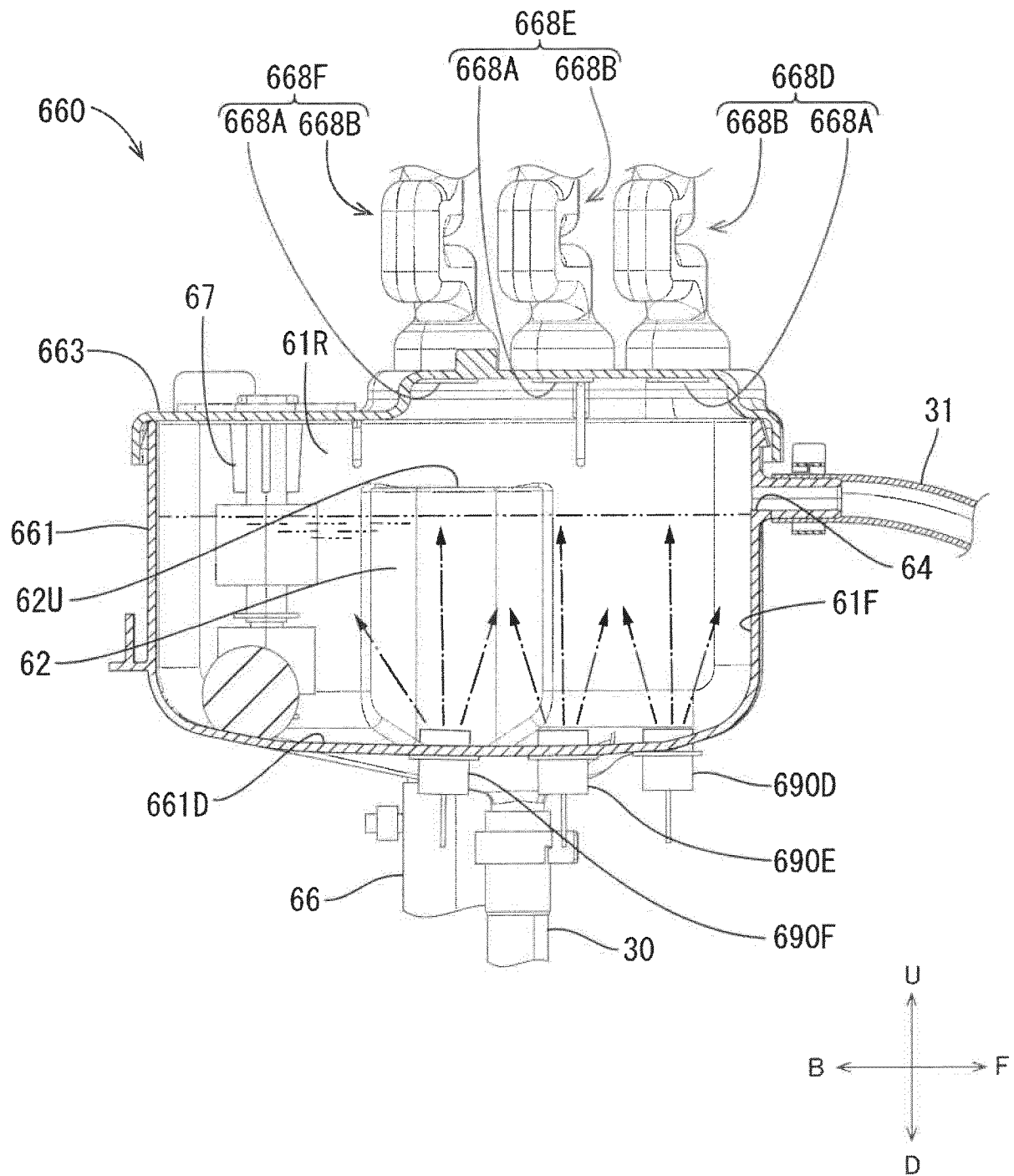


FIG.14

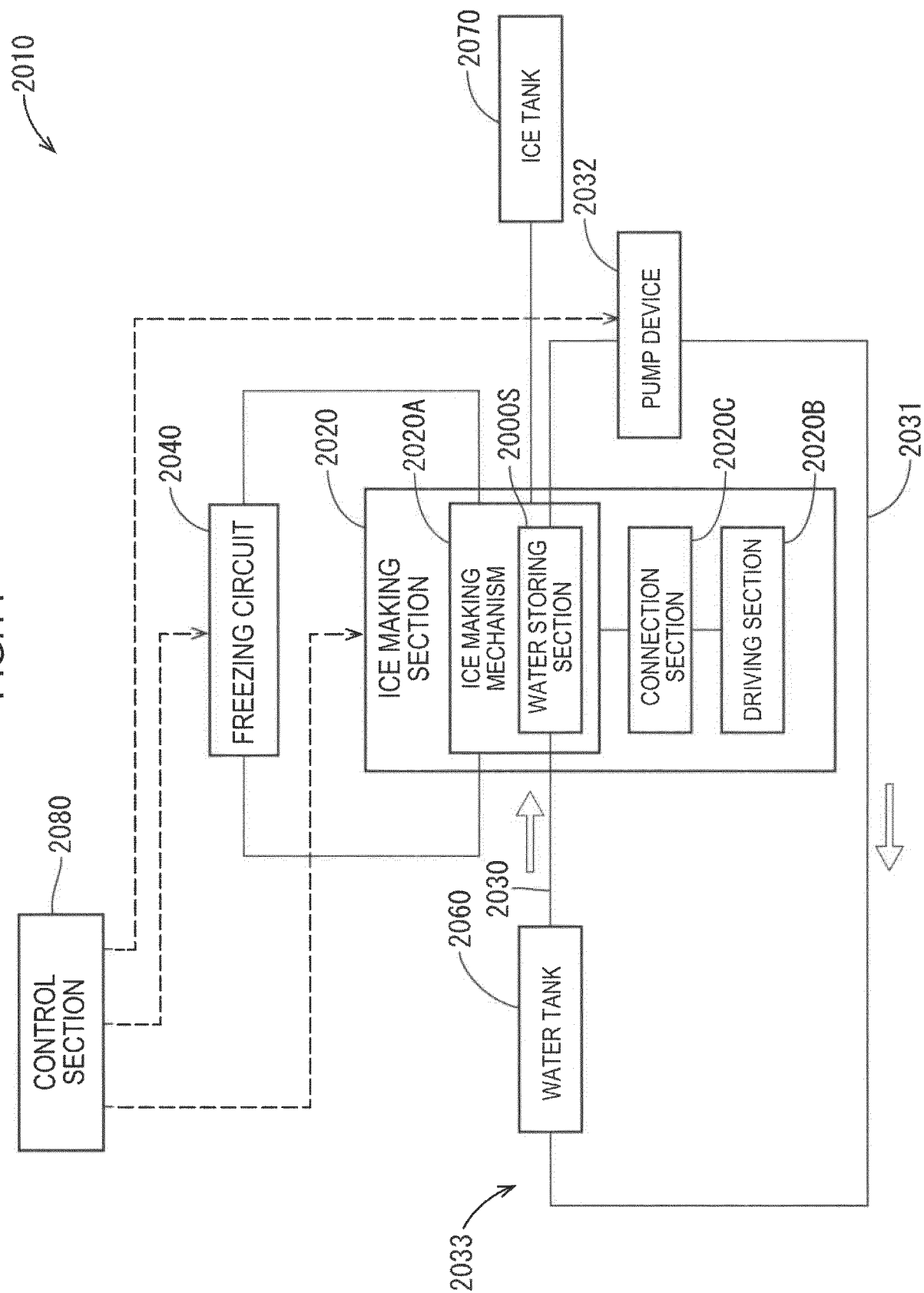


FIG.15

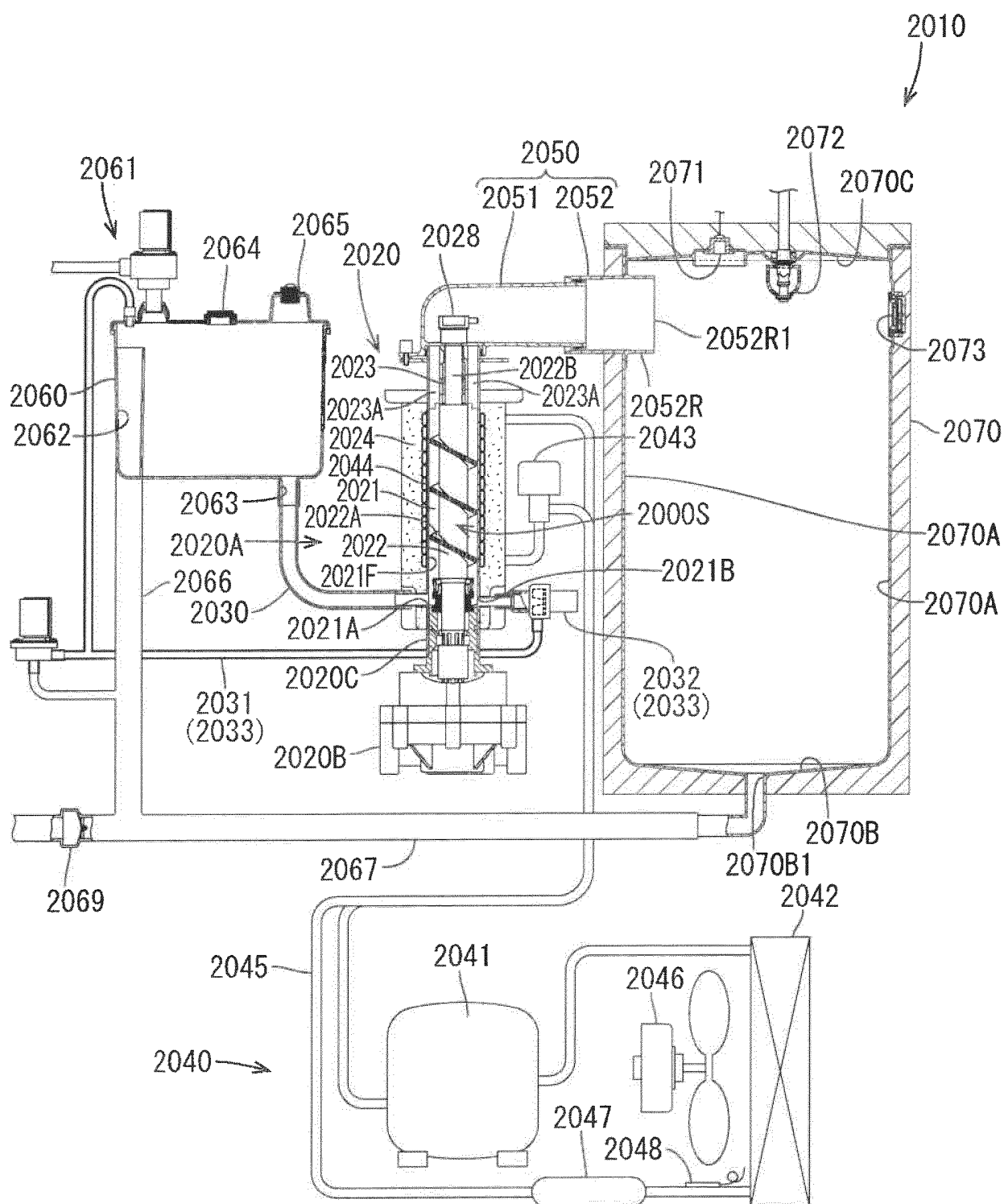


FIG.16

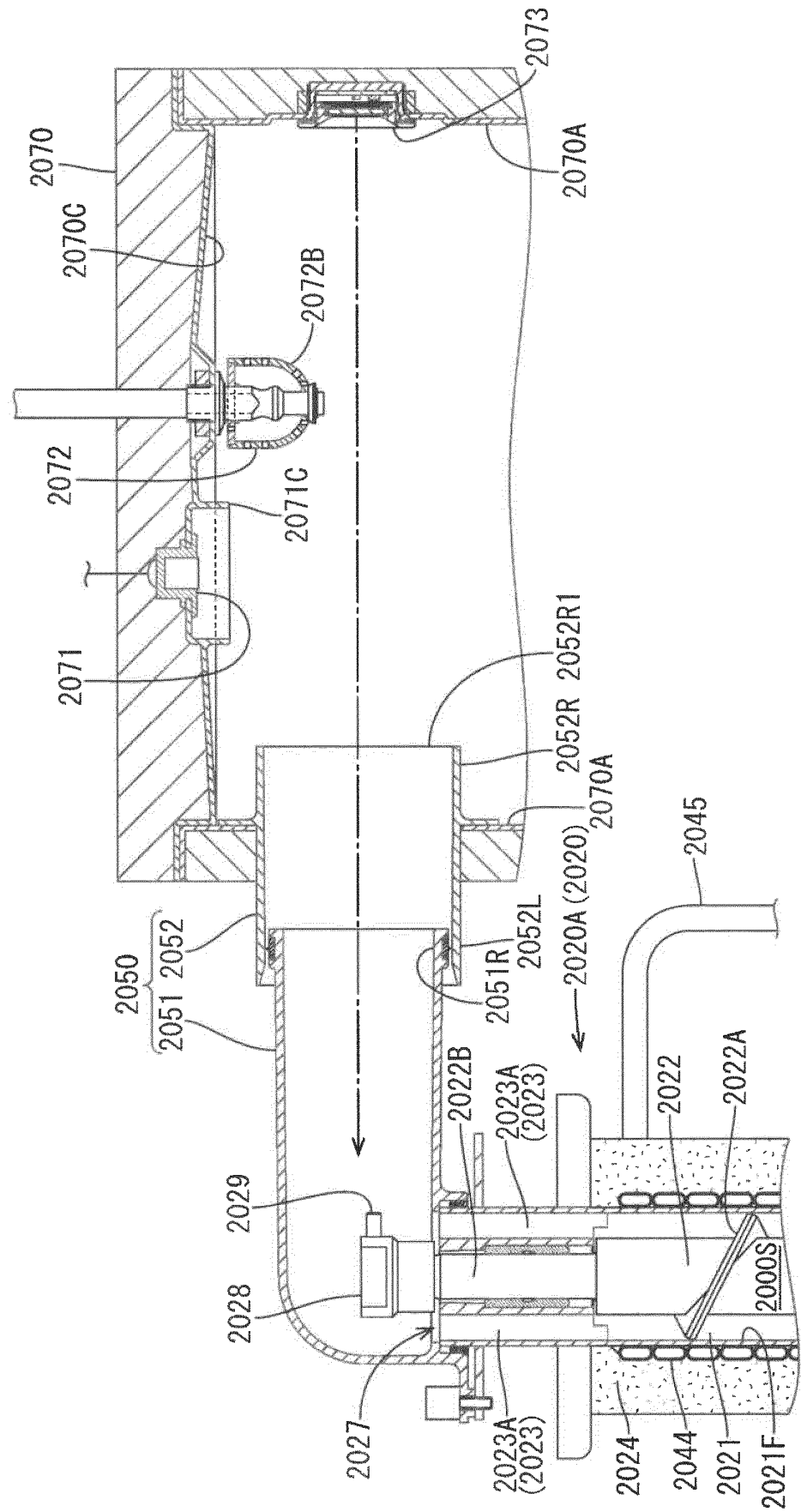


FIG.17

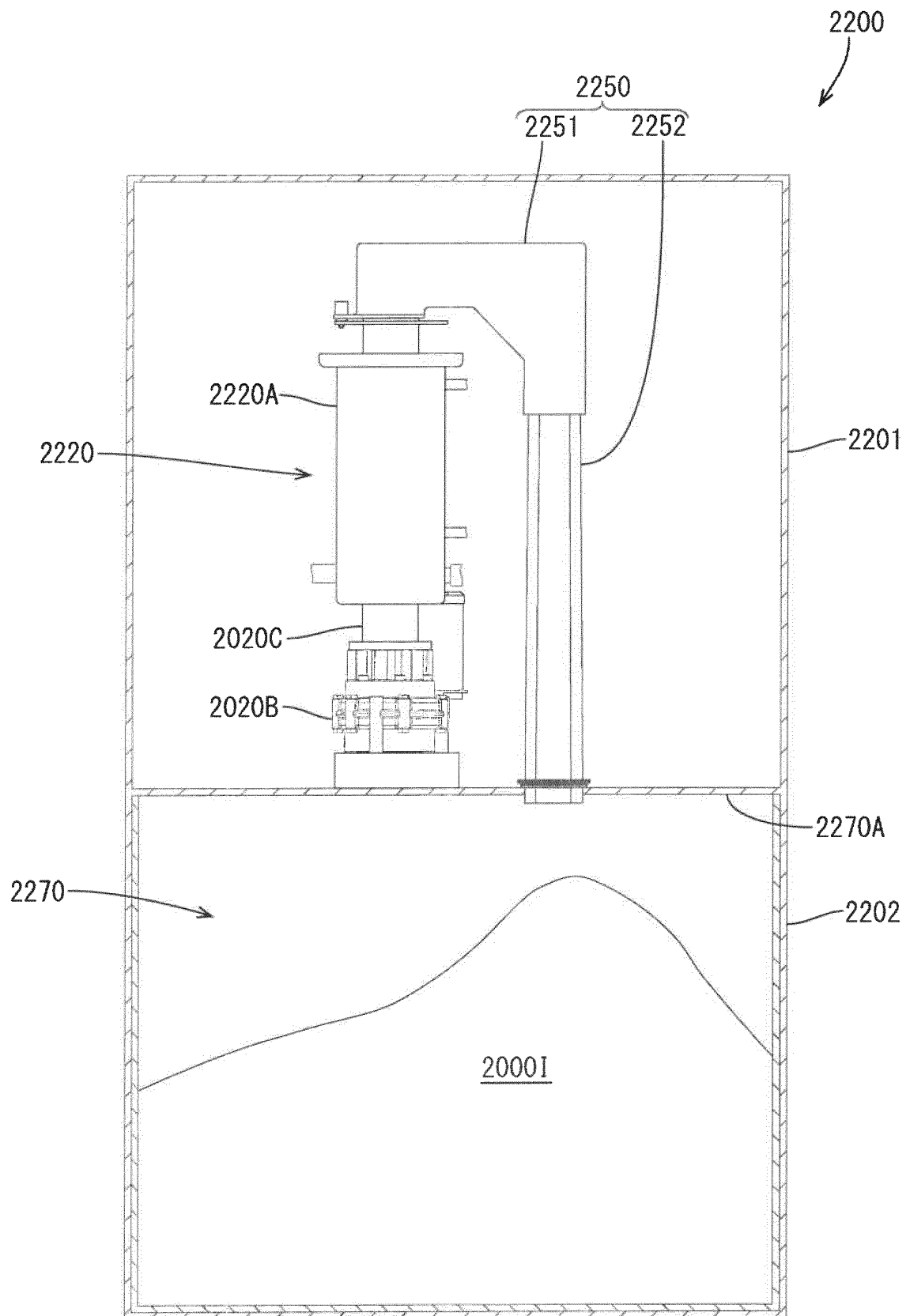


FIG.18

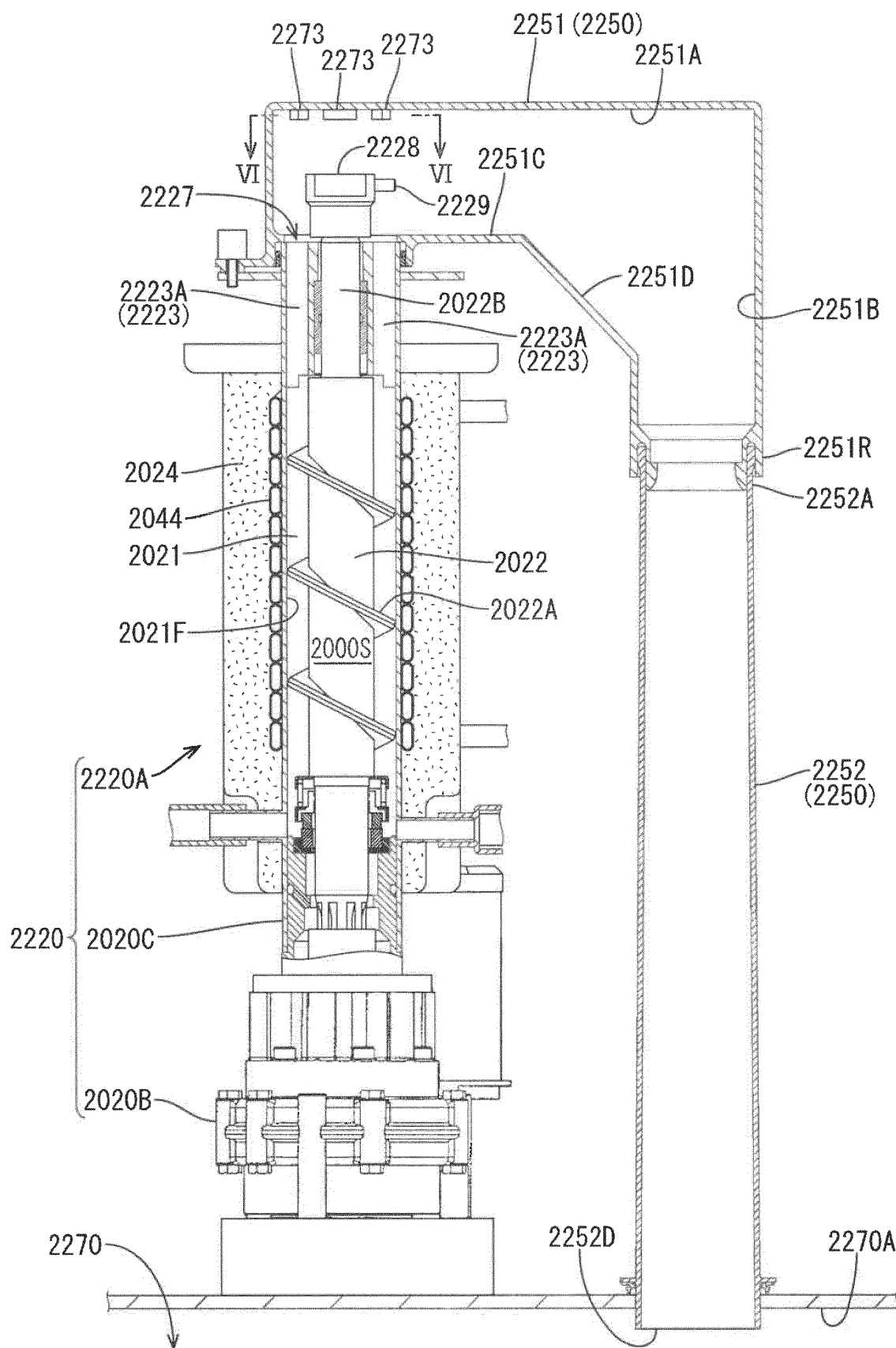


FIG.19

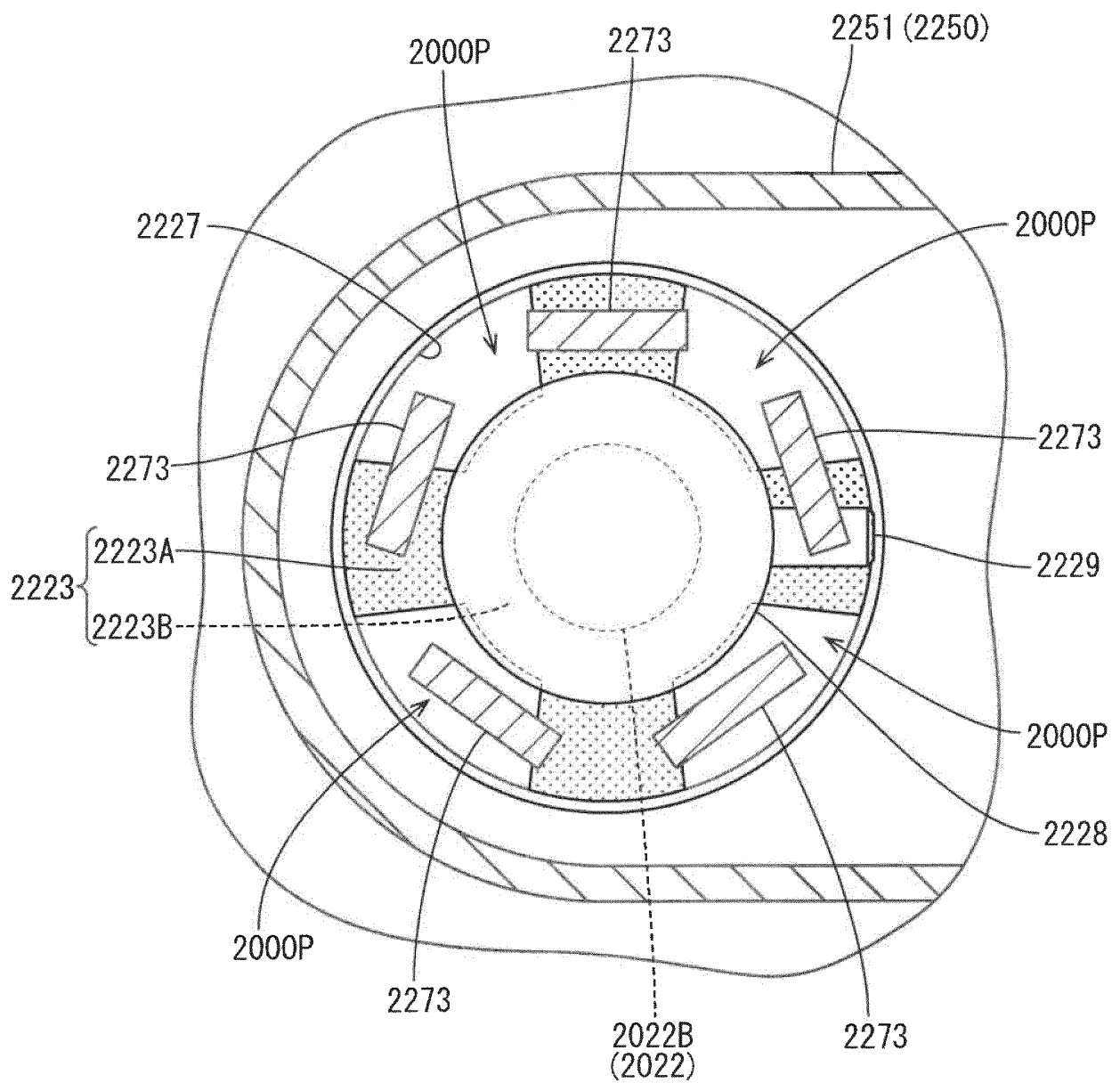


FIG.20

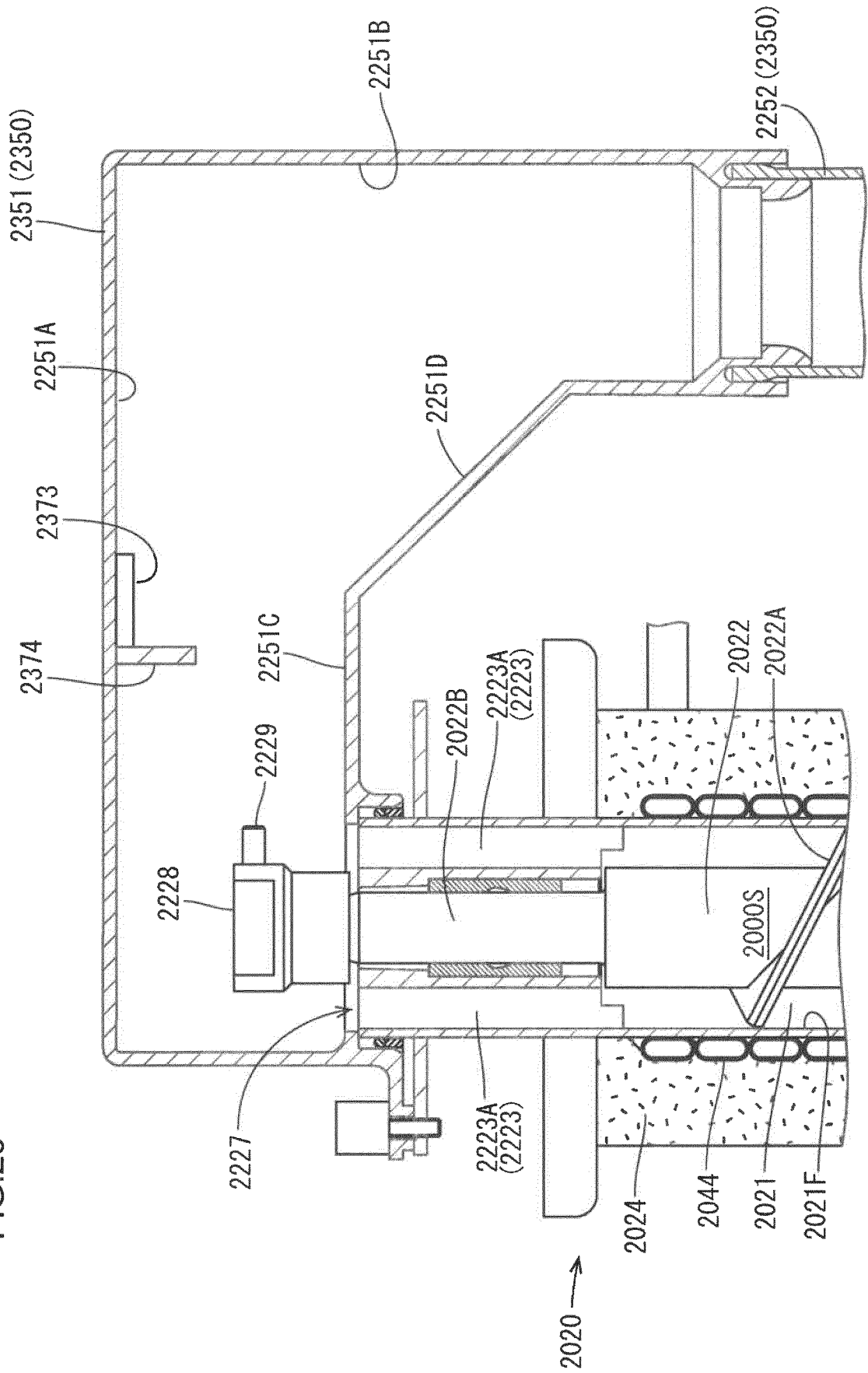


FIG.21

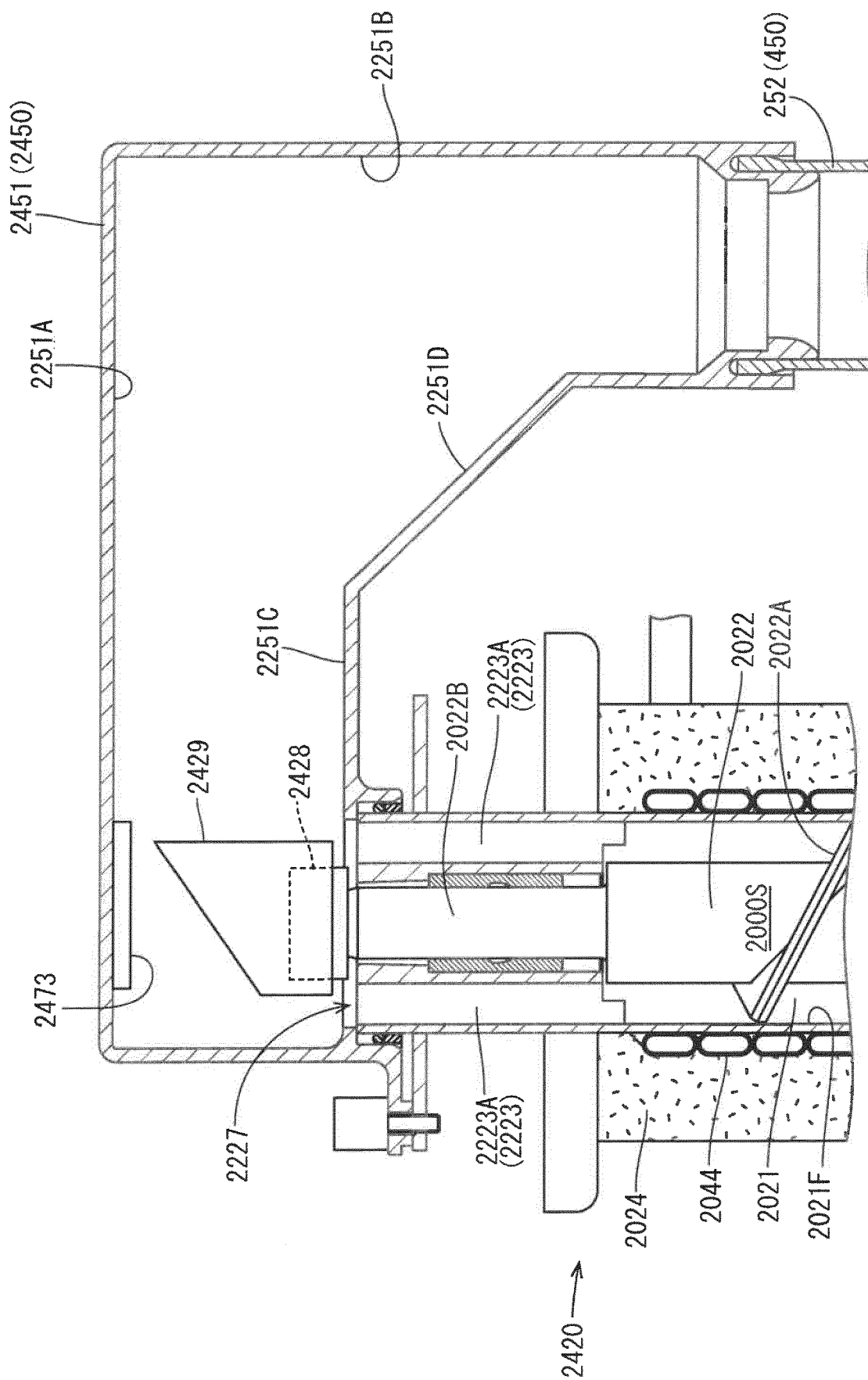


FIG.22

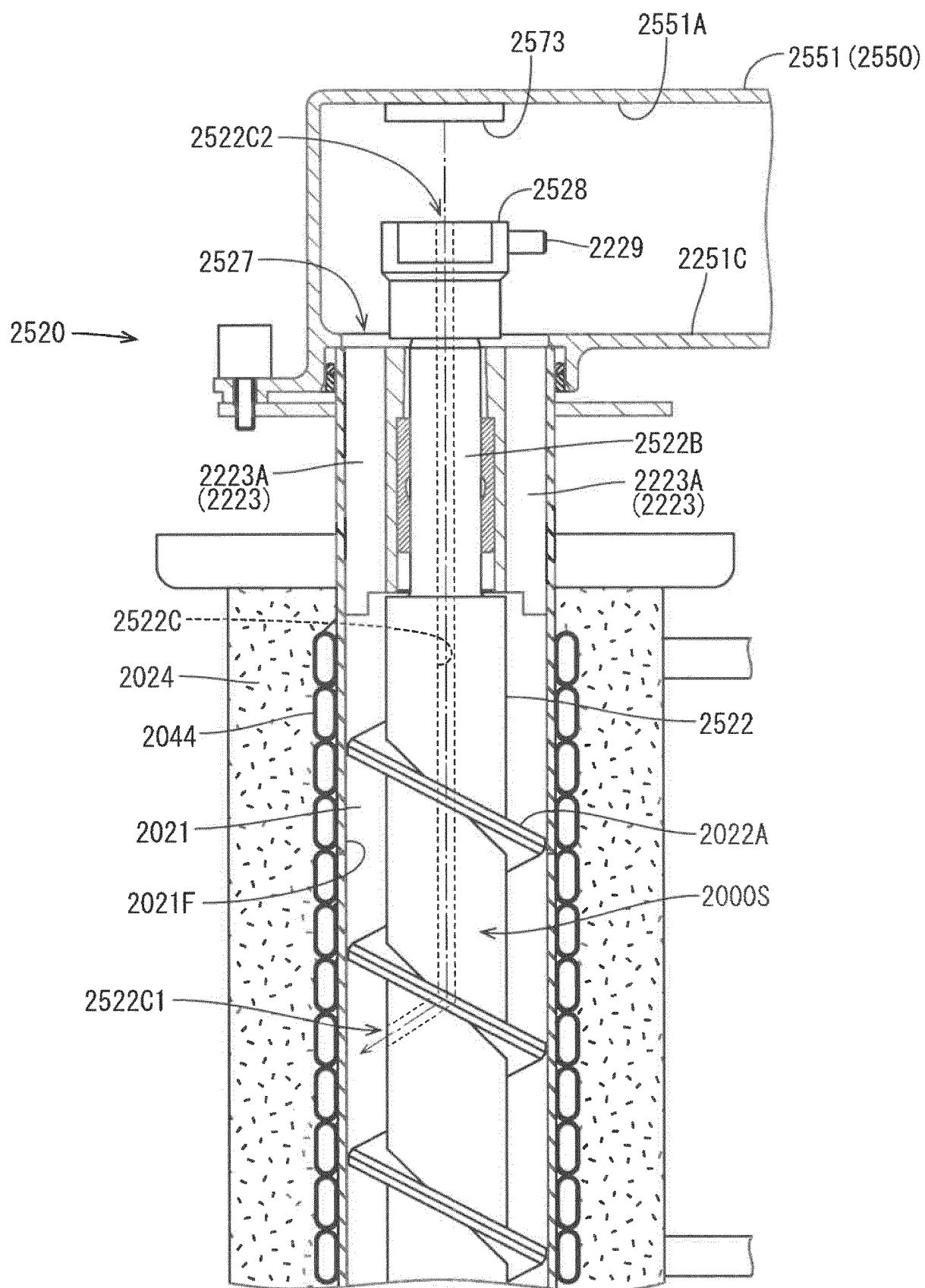


FIG.23

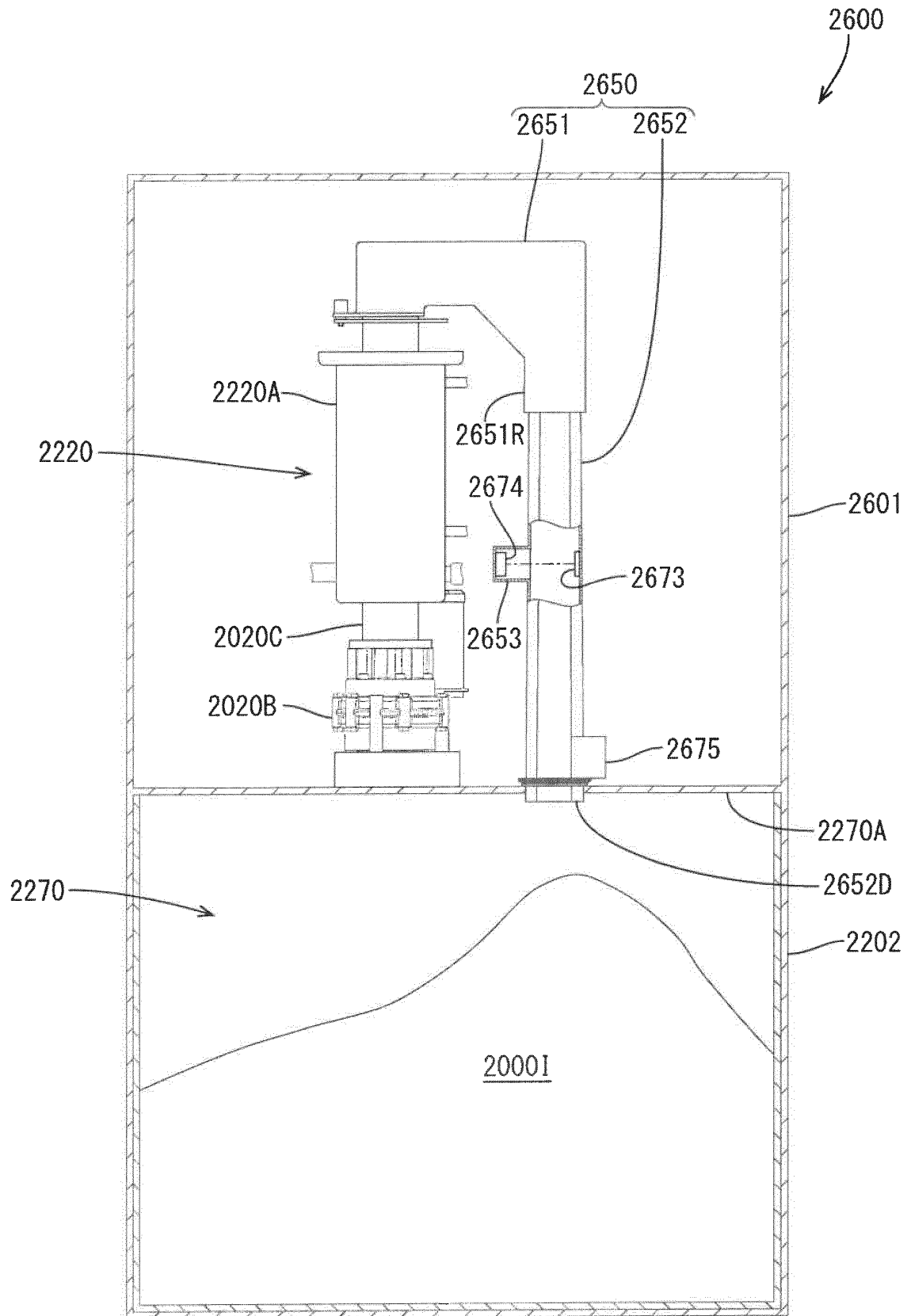


FIG.24

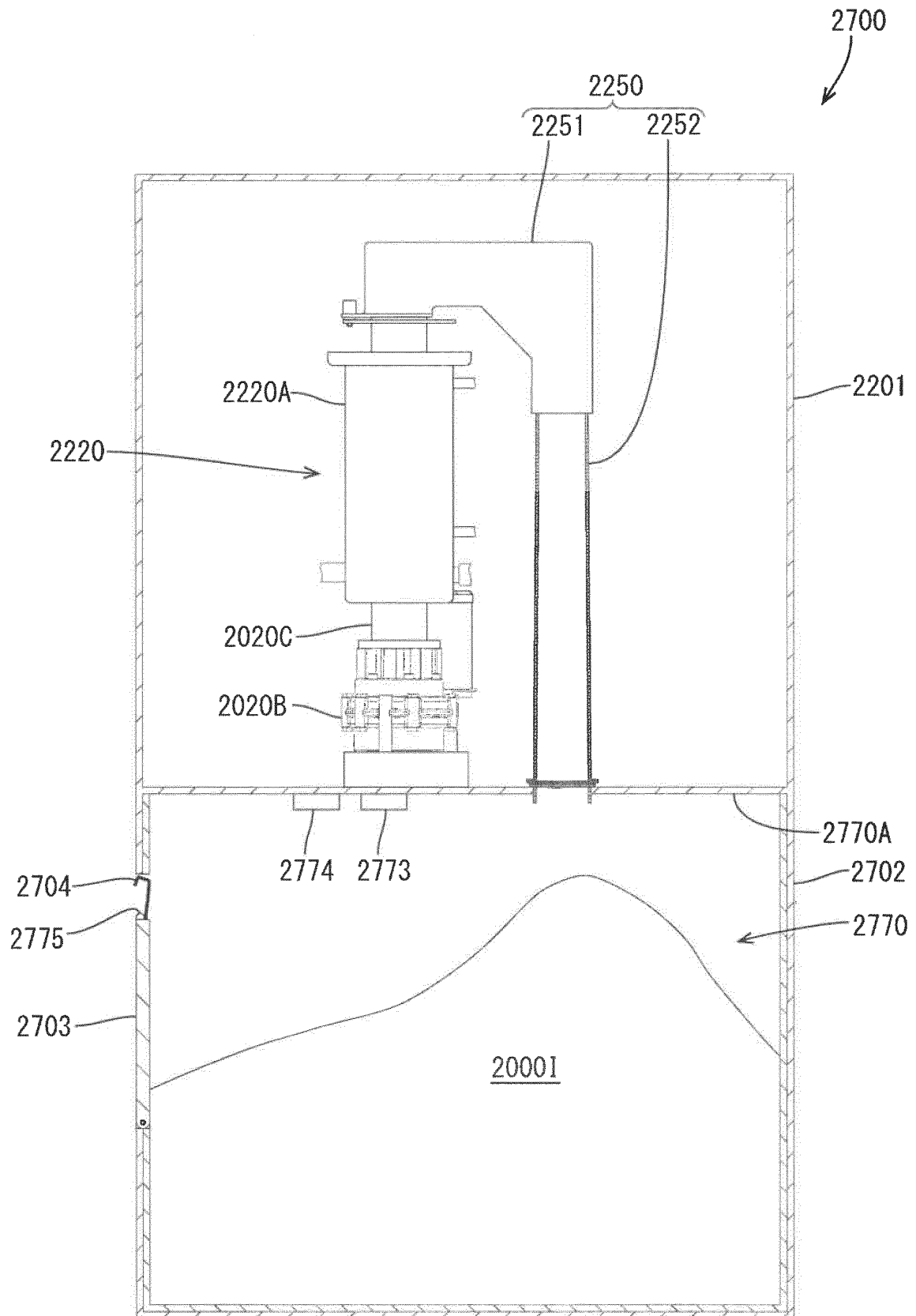


FIG.25

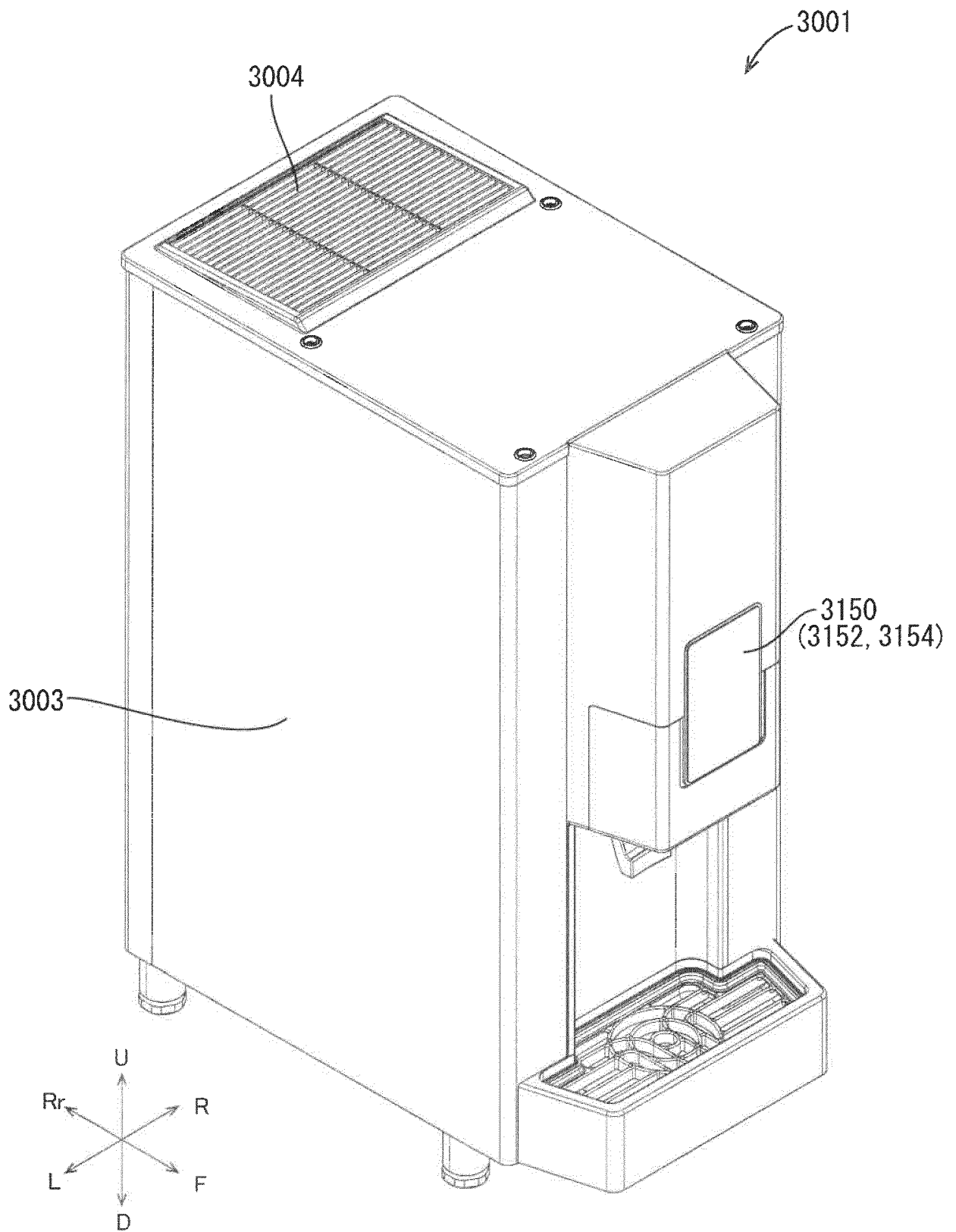


FIG.26

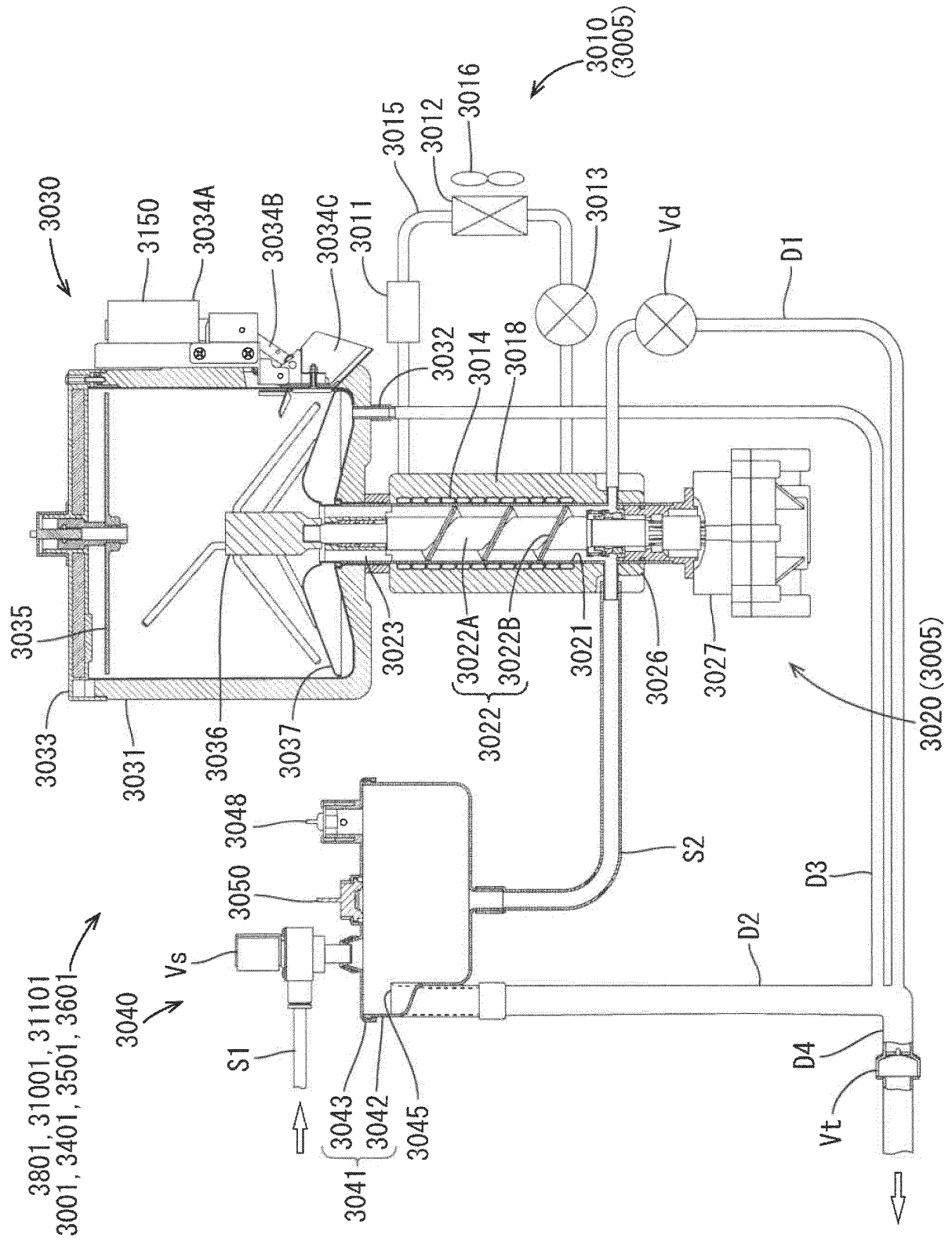


FIG.27

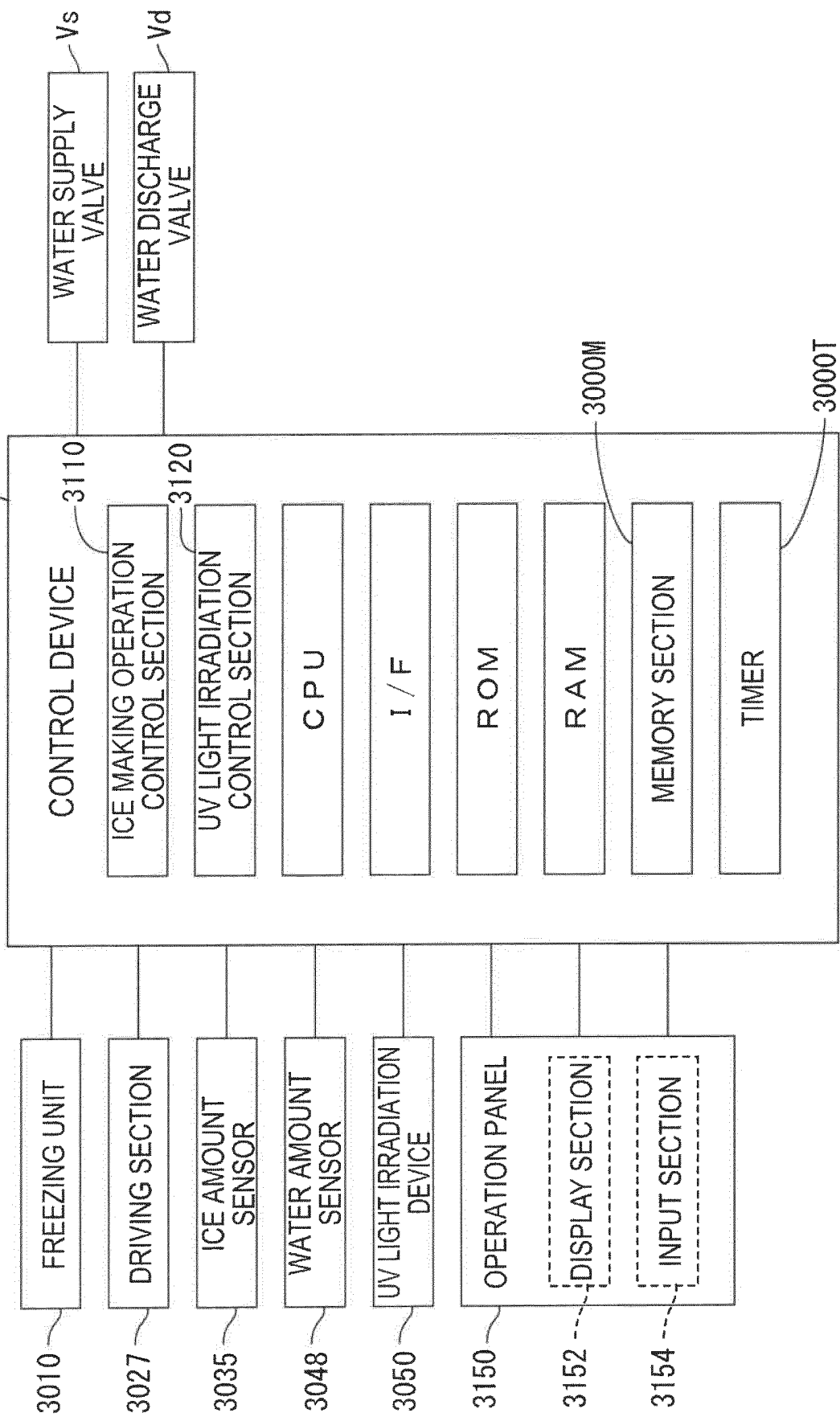


FIG.28

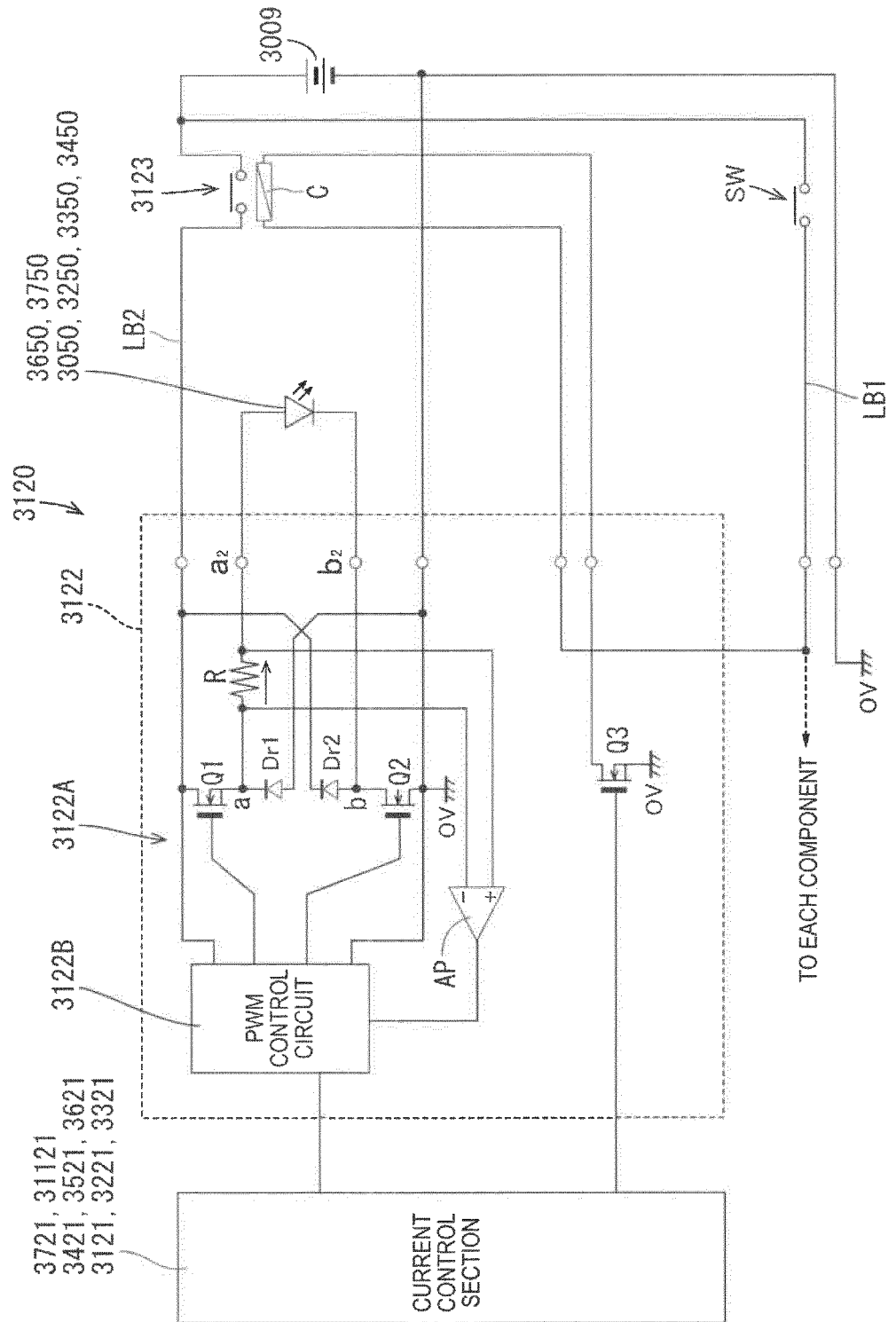


FIG.29

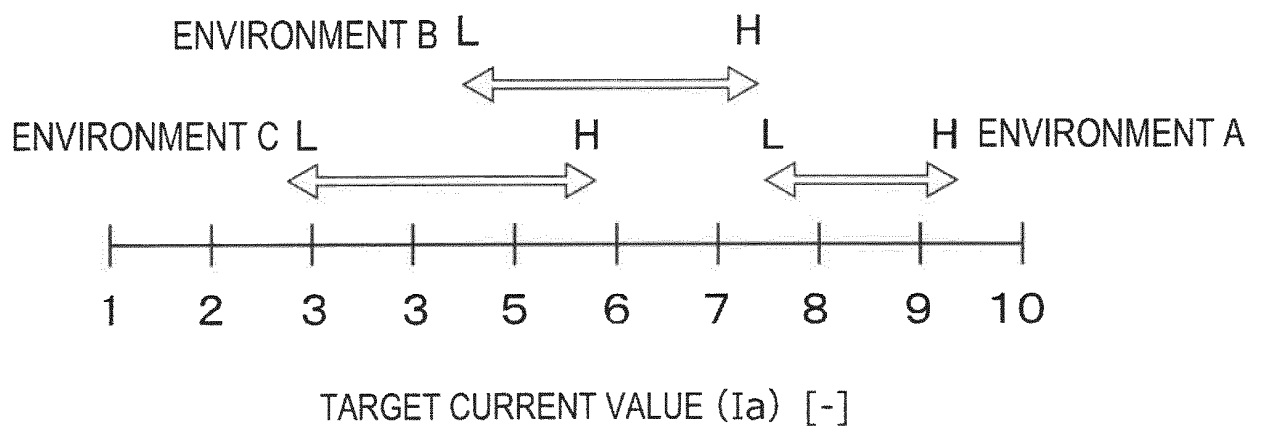


FIG.30

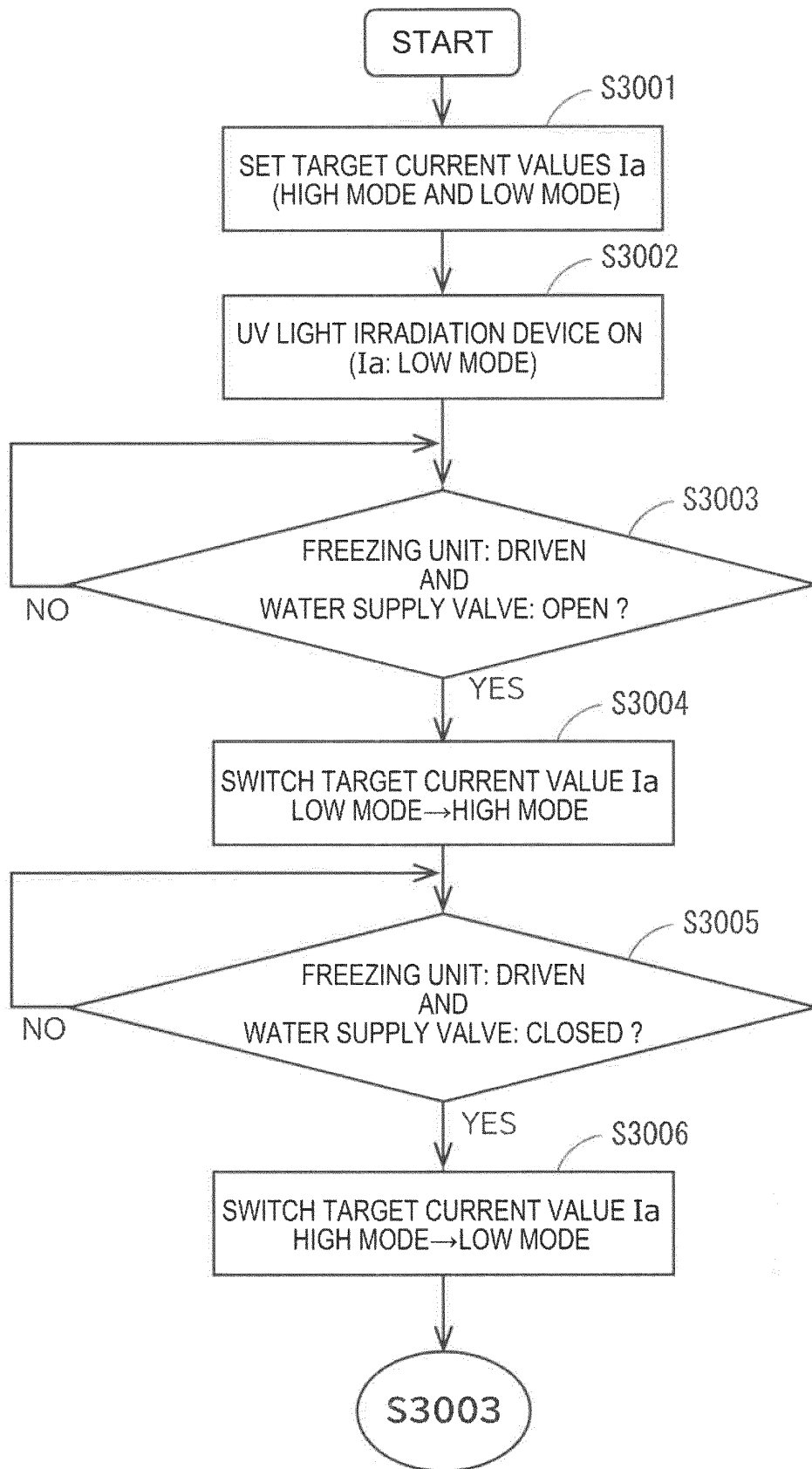
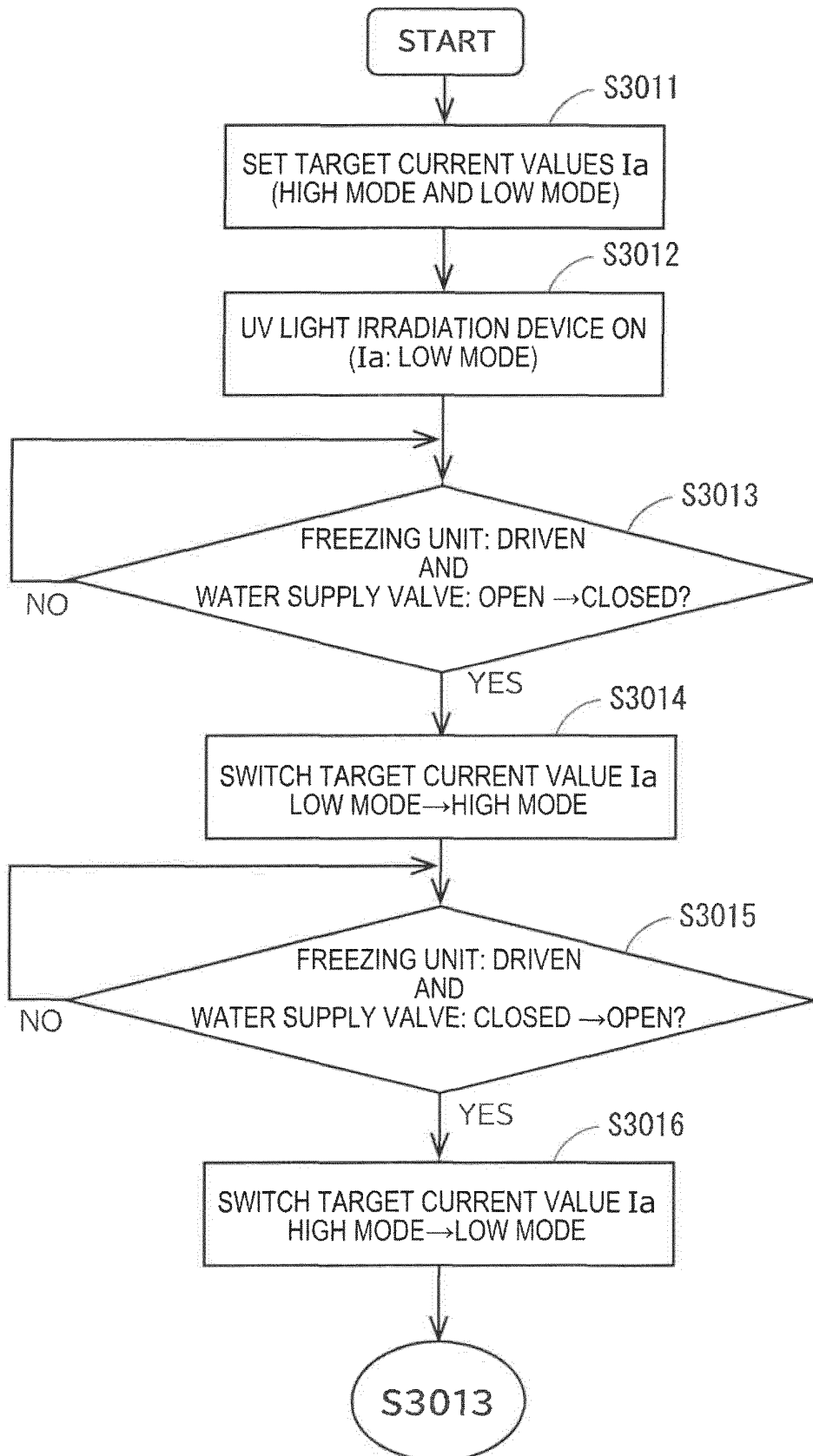


FIG.31



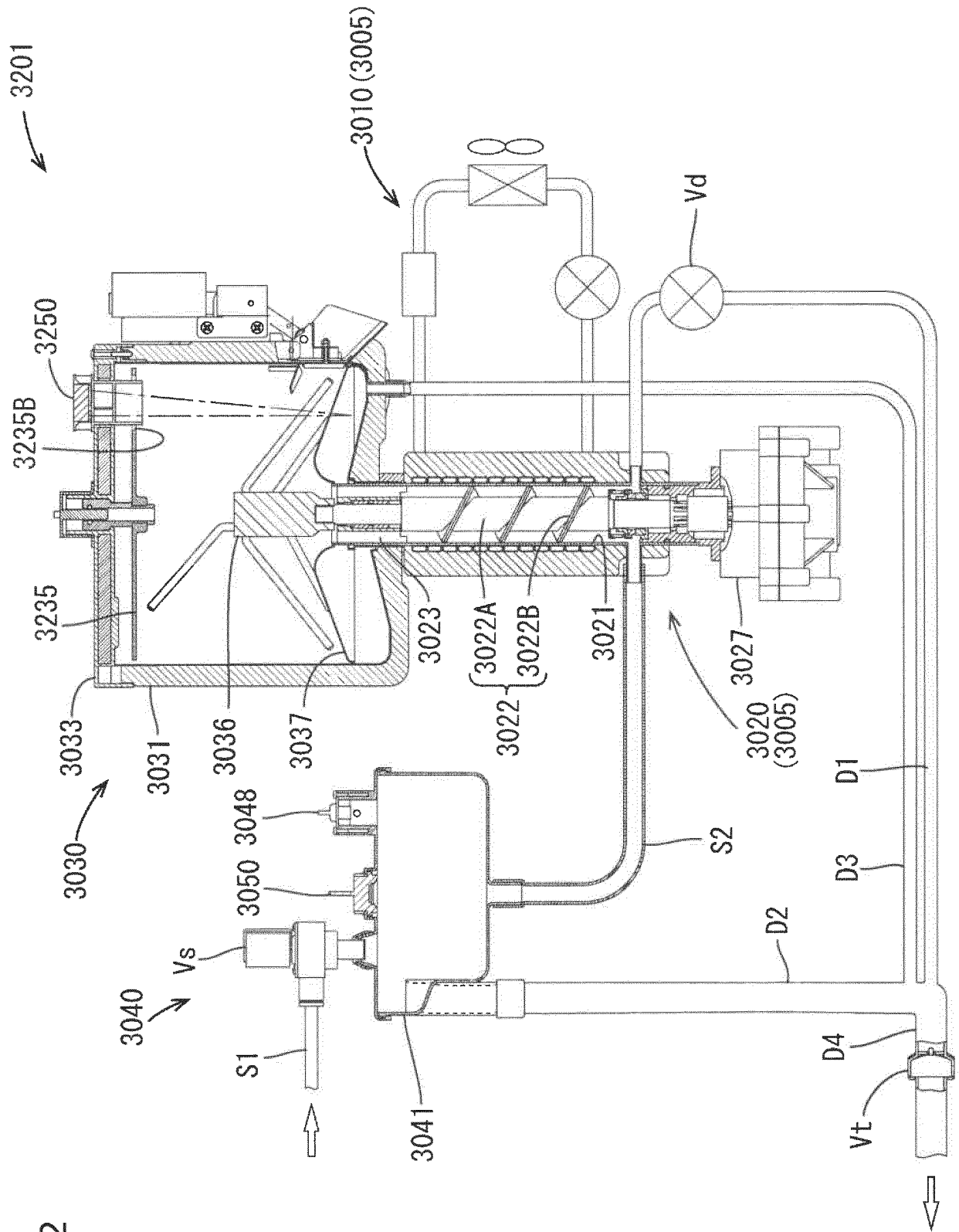
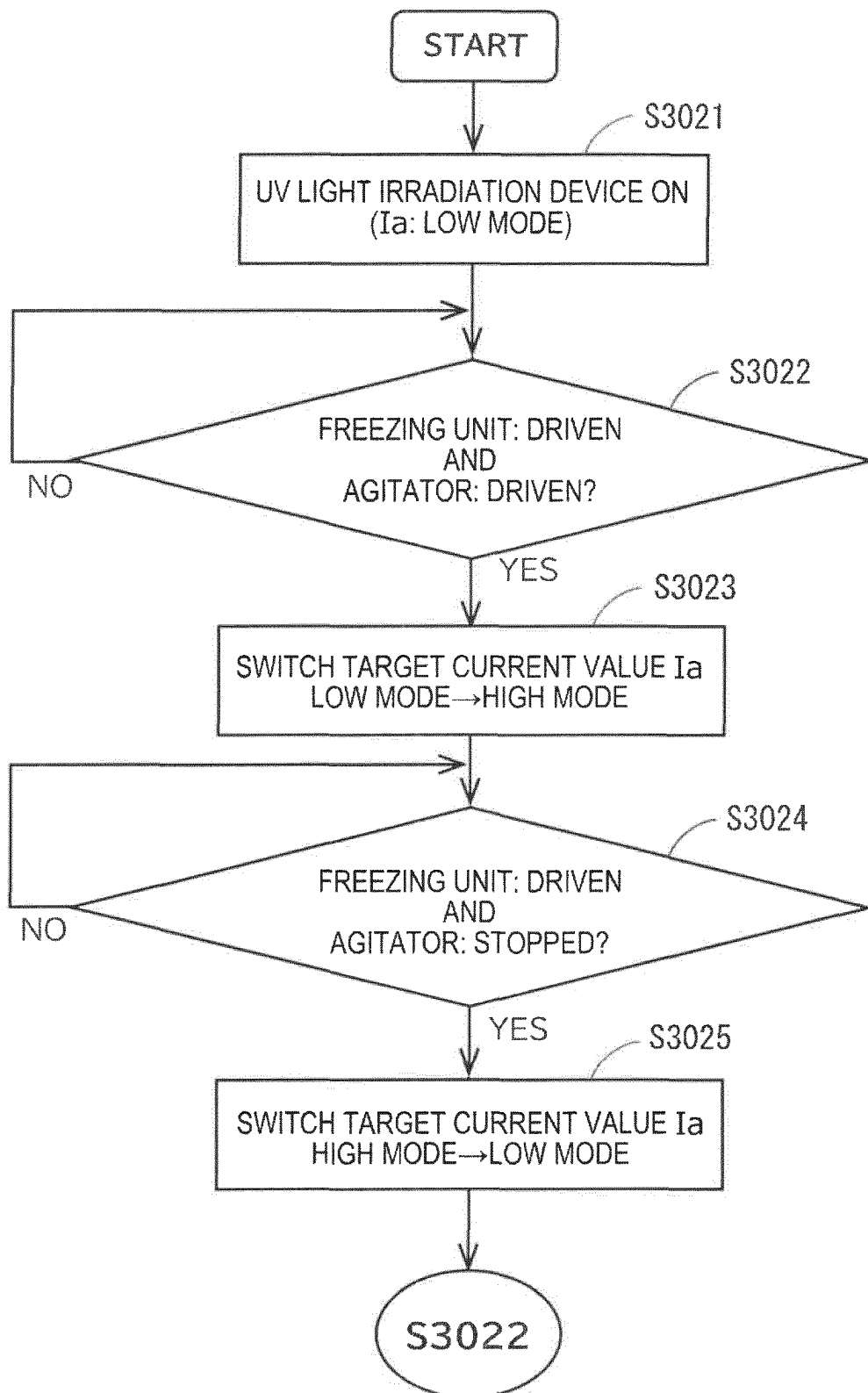


FIG. 32

FIG.33



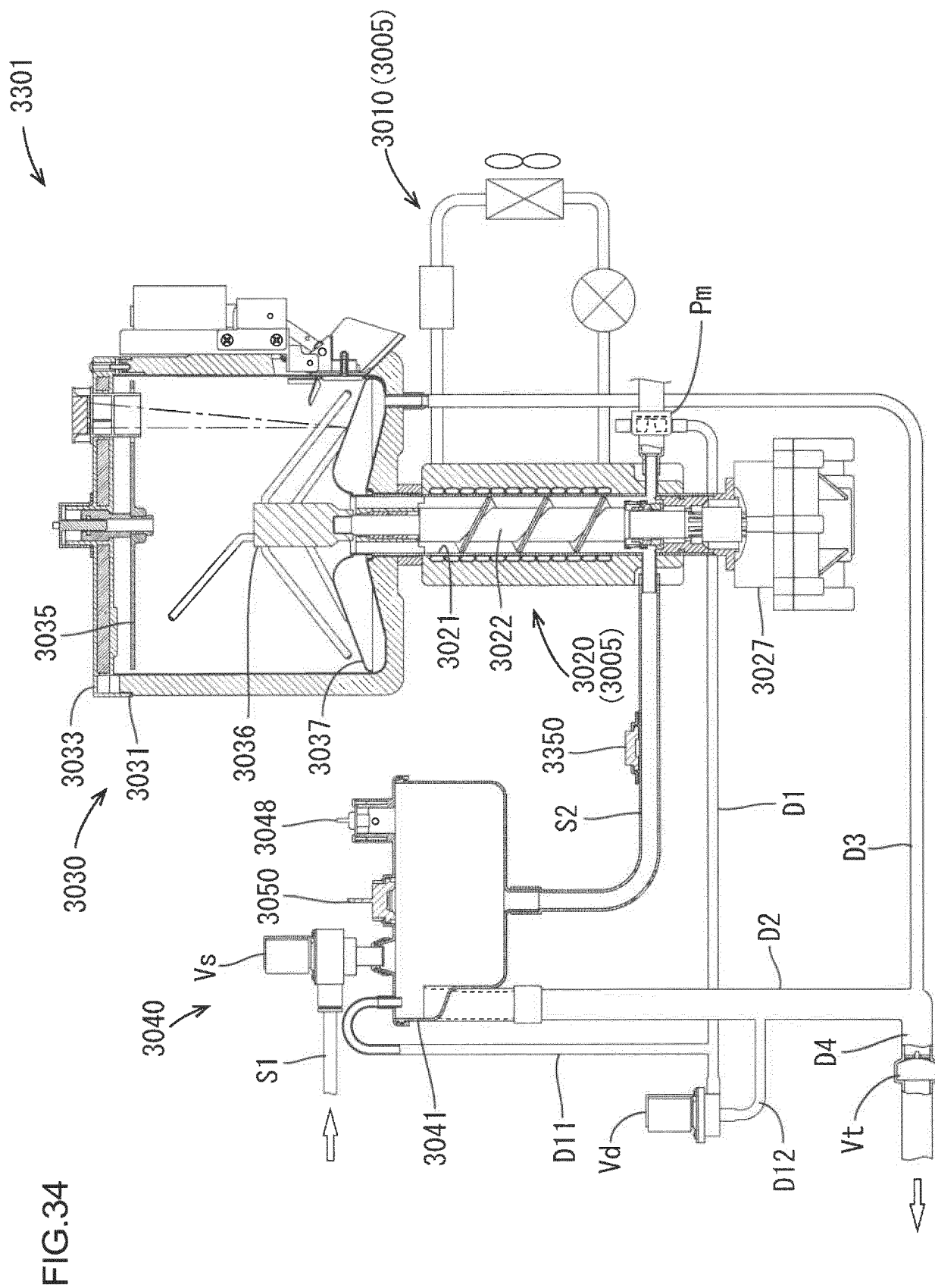


FIG.35

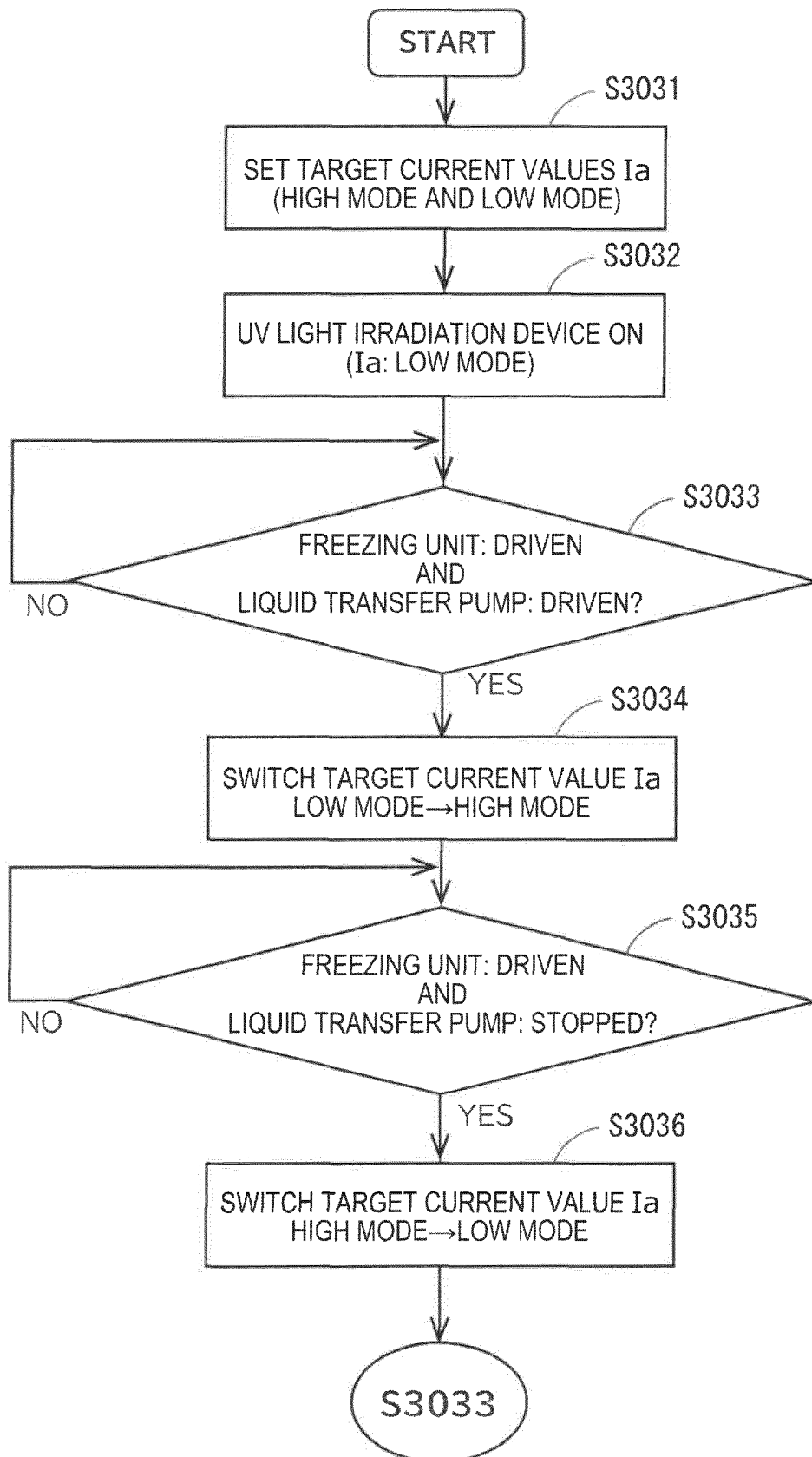


FIG.36

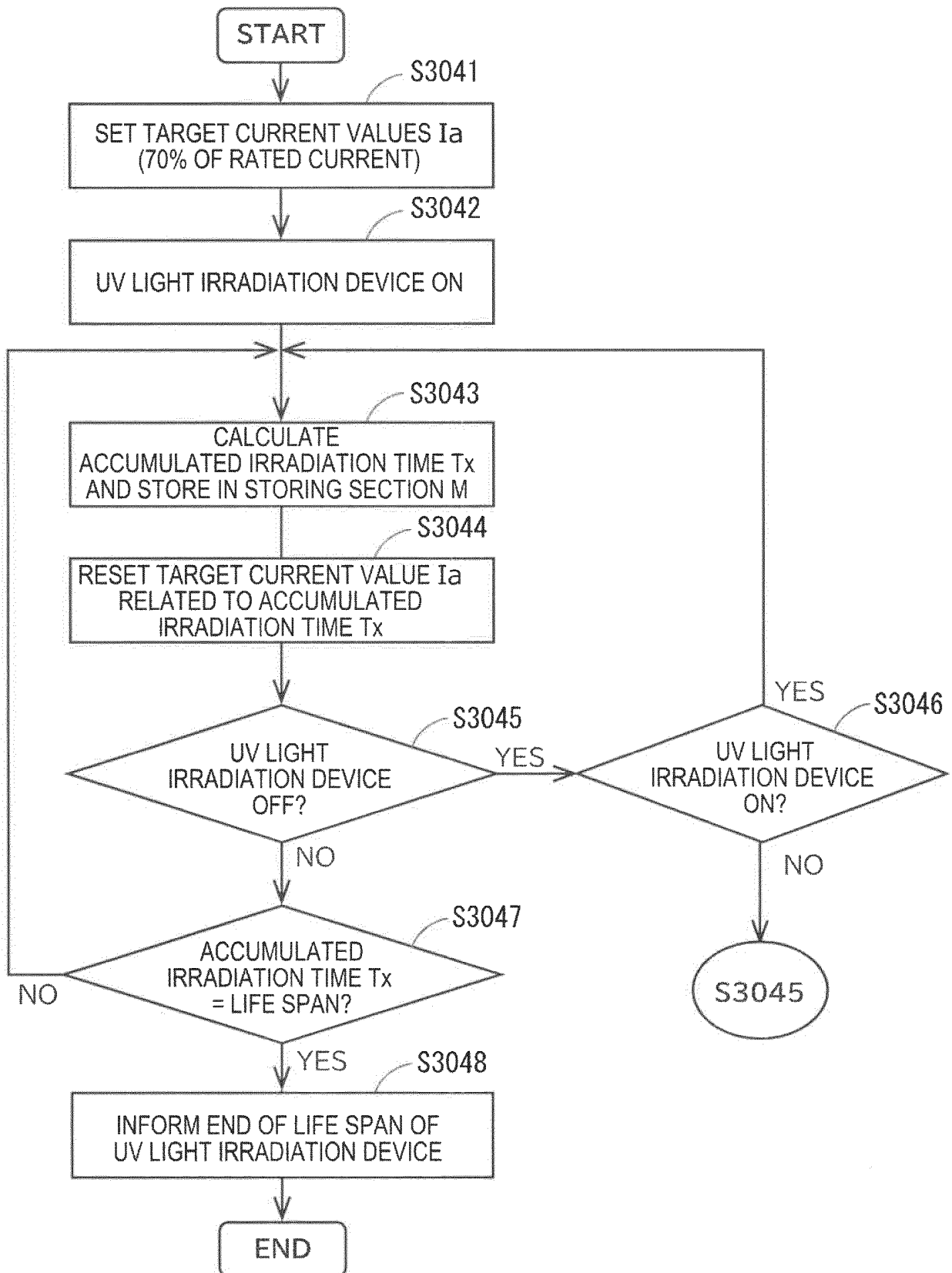


FIG.37

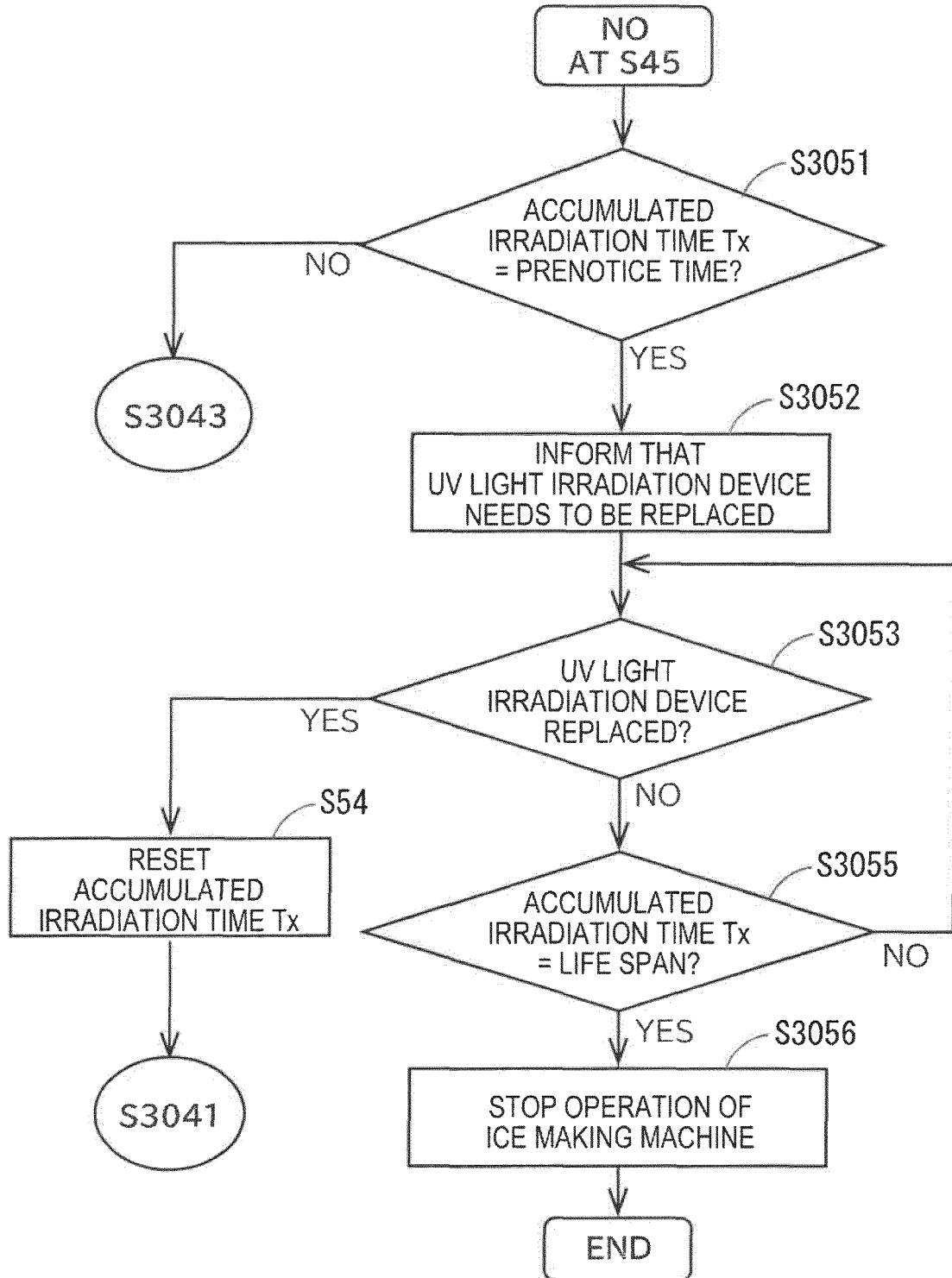


FIG.38

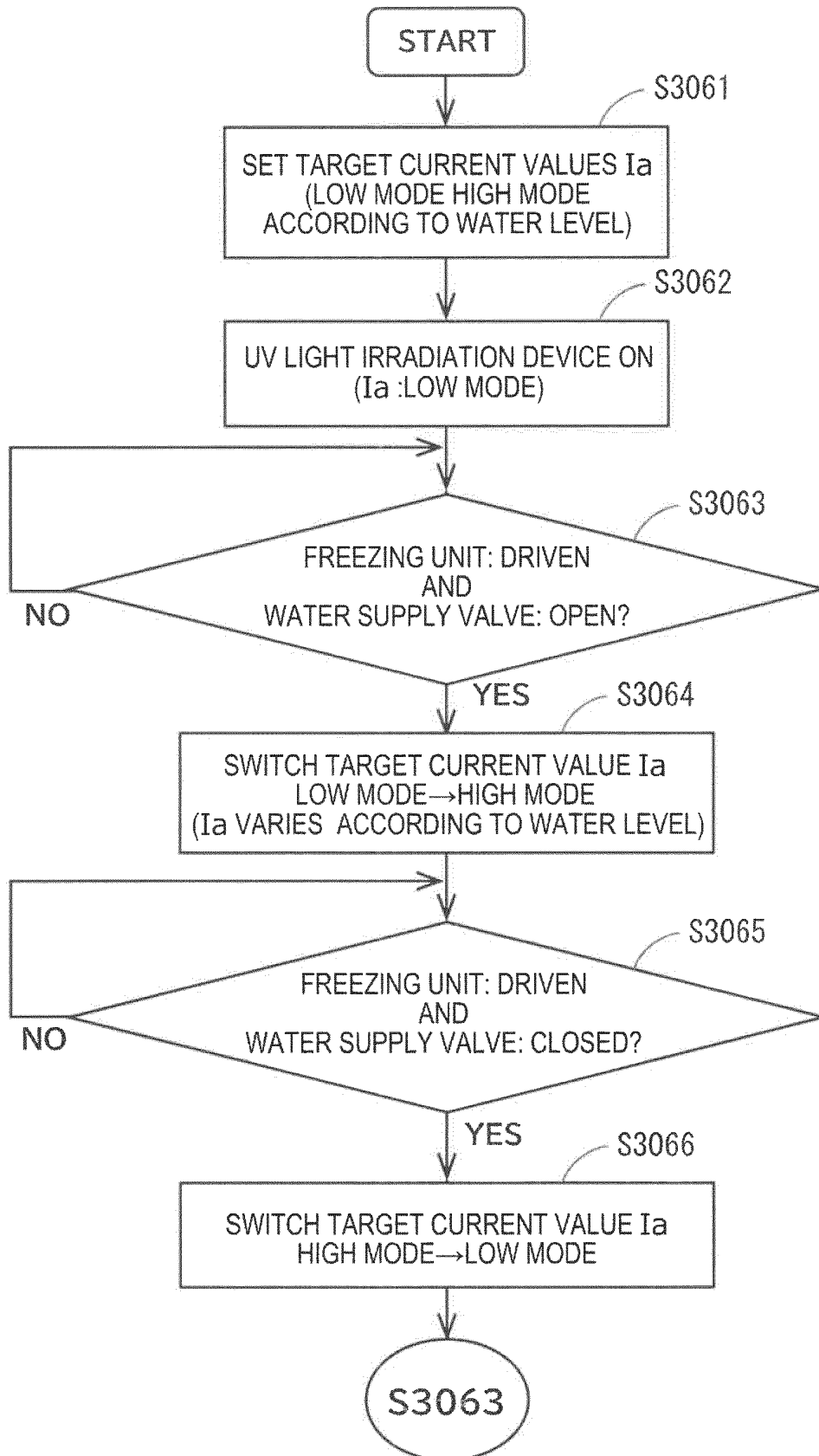


FIG.39

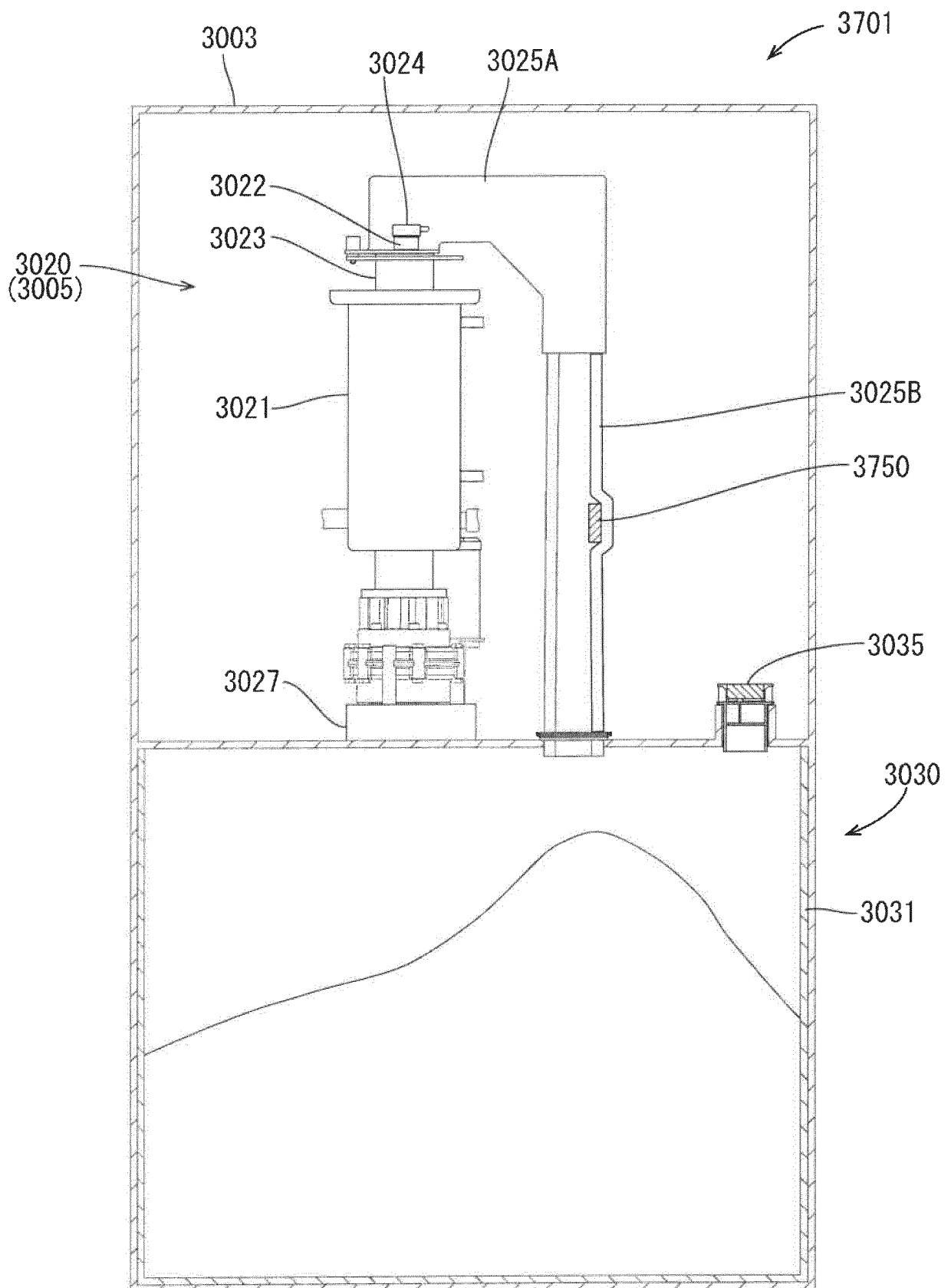


FIG.40

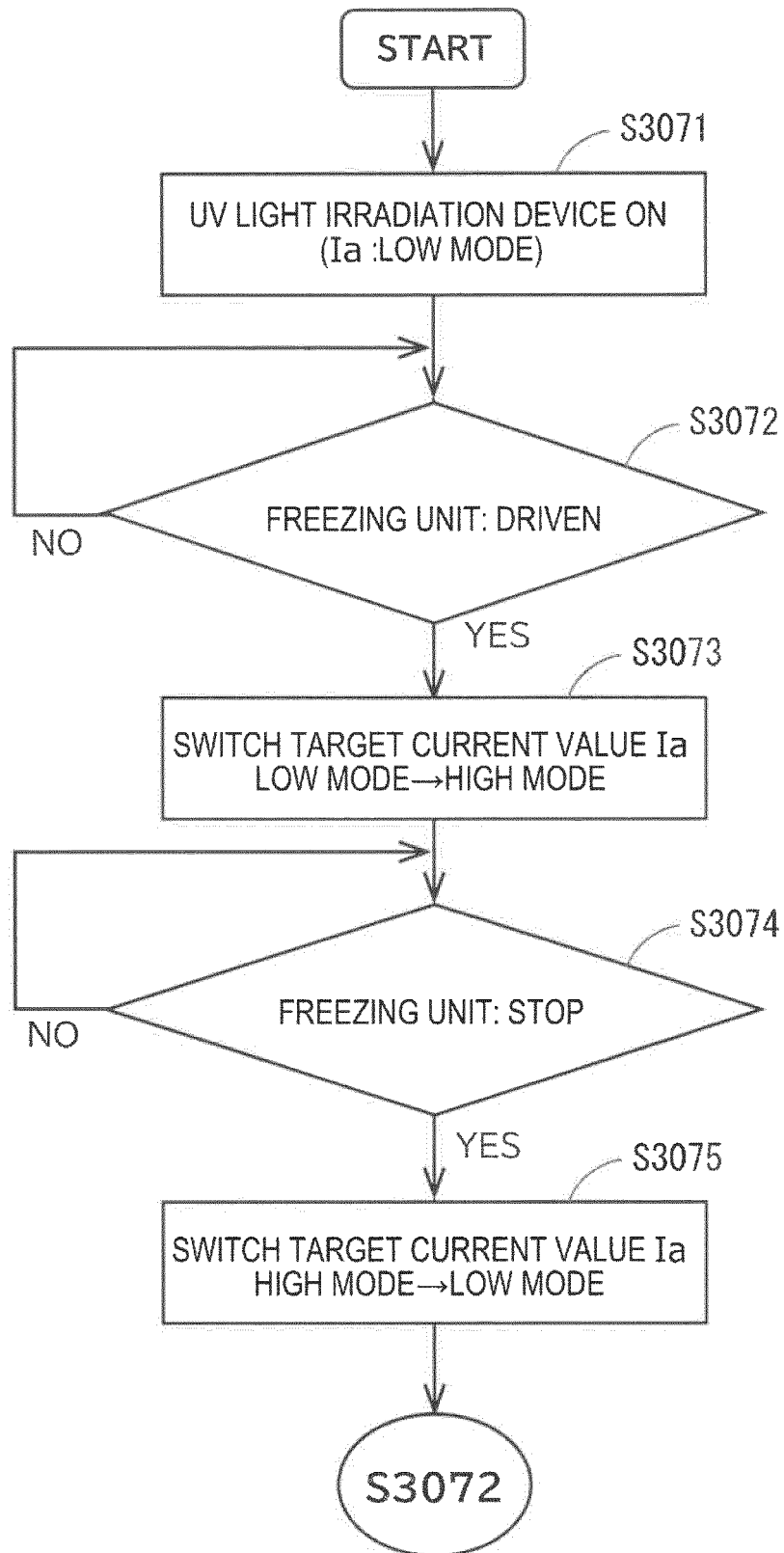


FIG.41

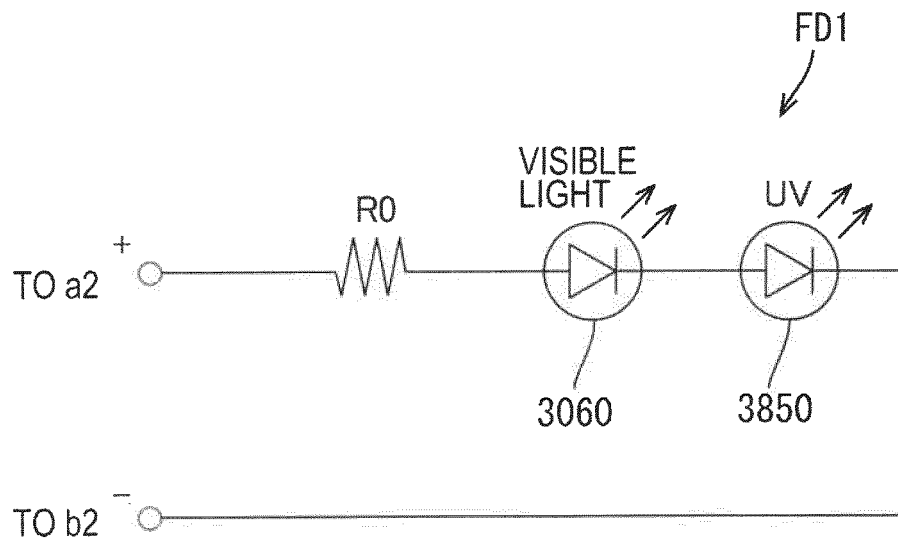


FIG.42

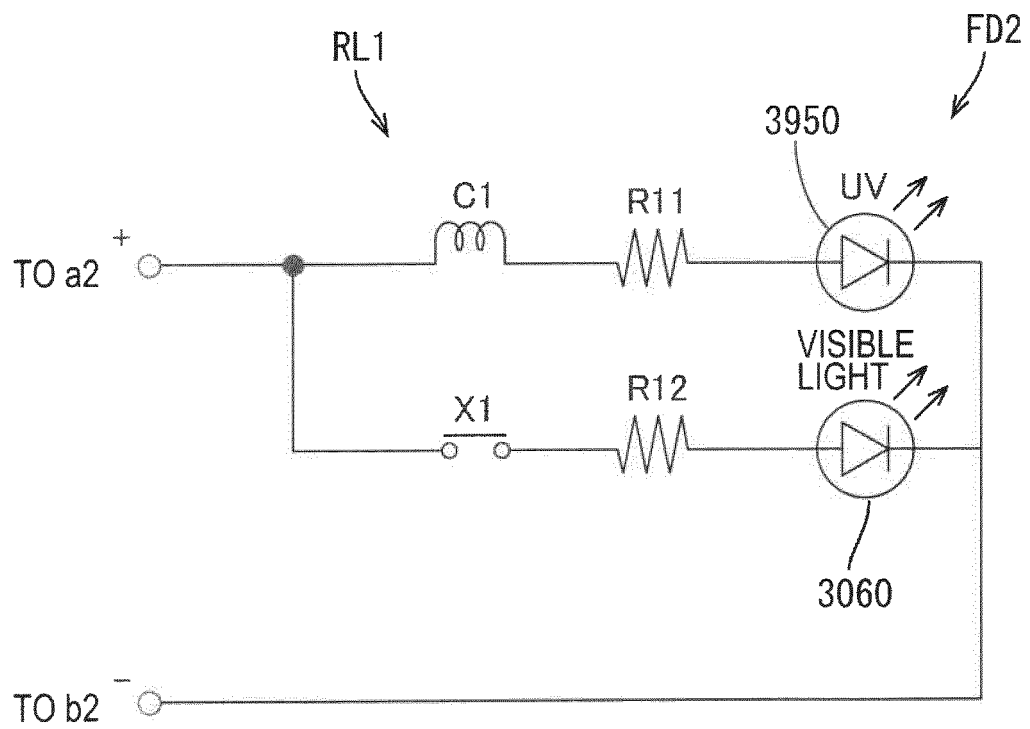


FIG.43

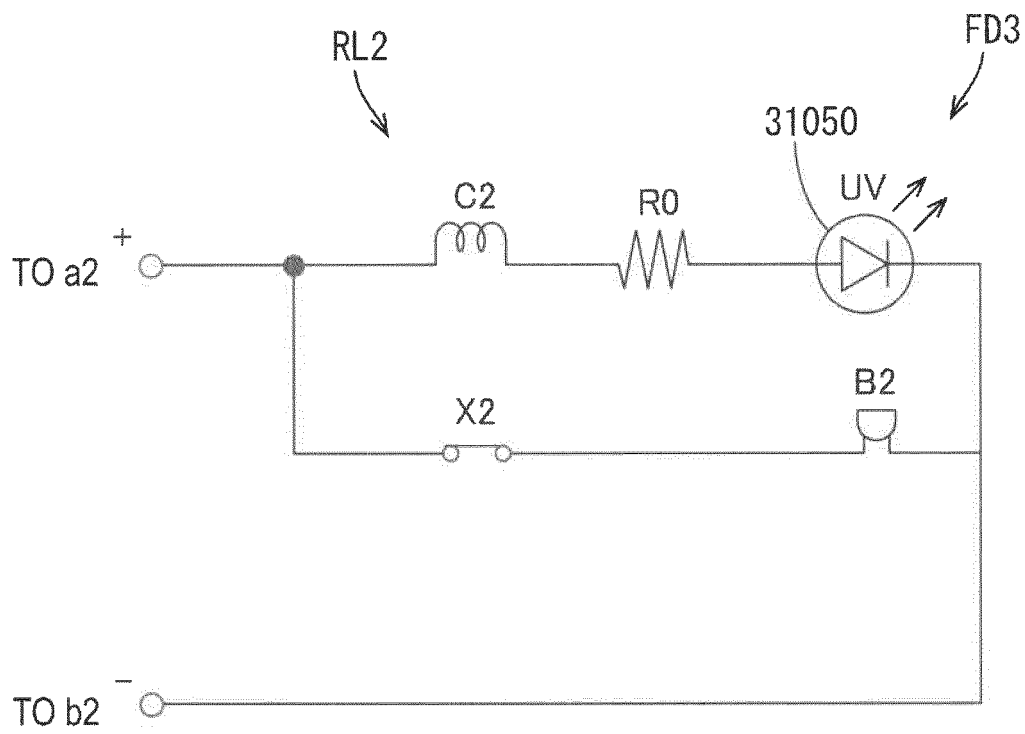


FIG.44

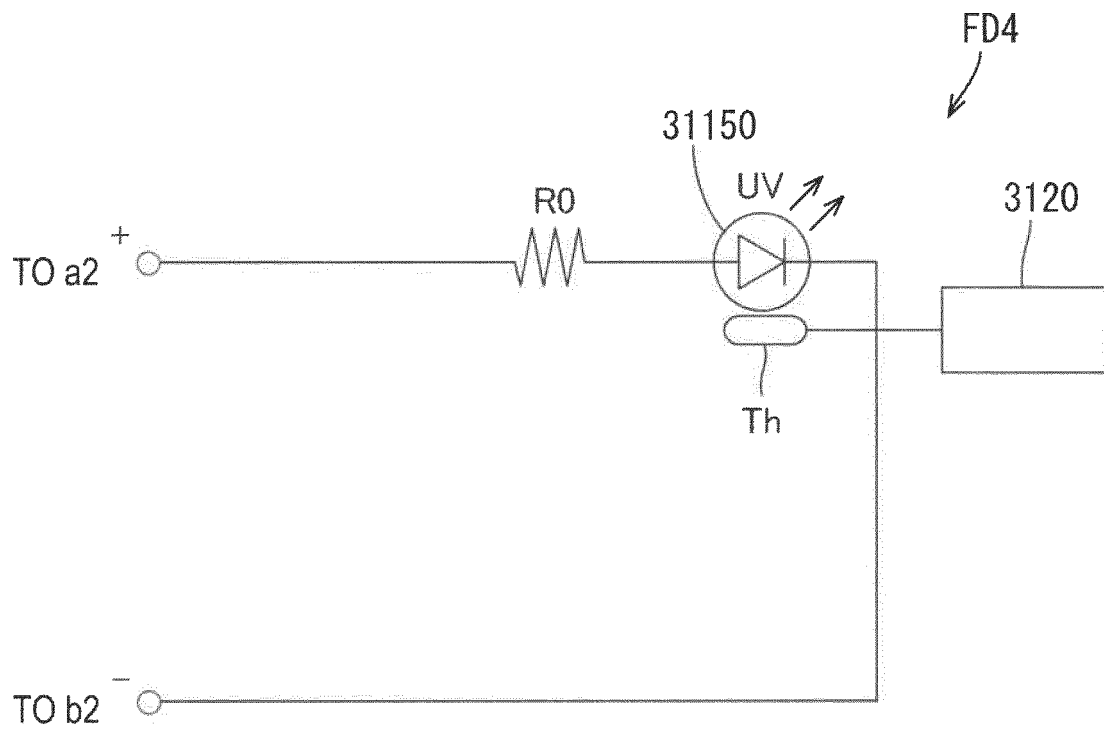


FIG.45

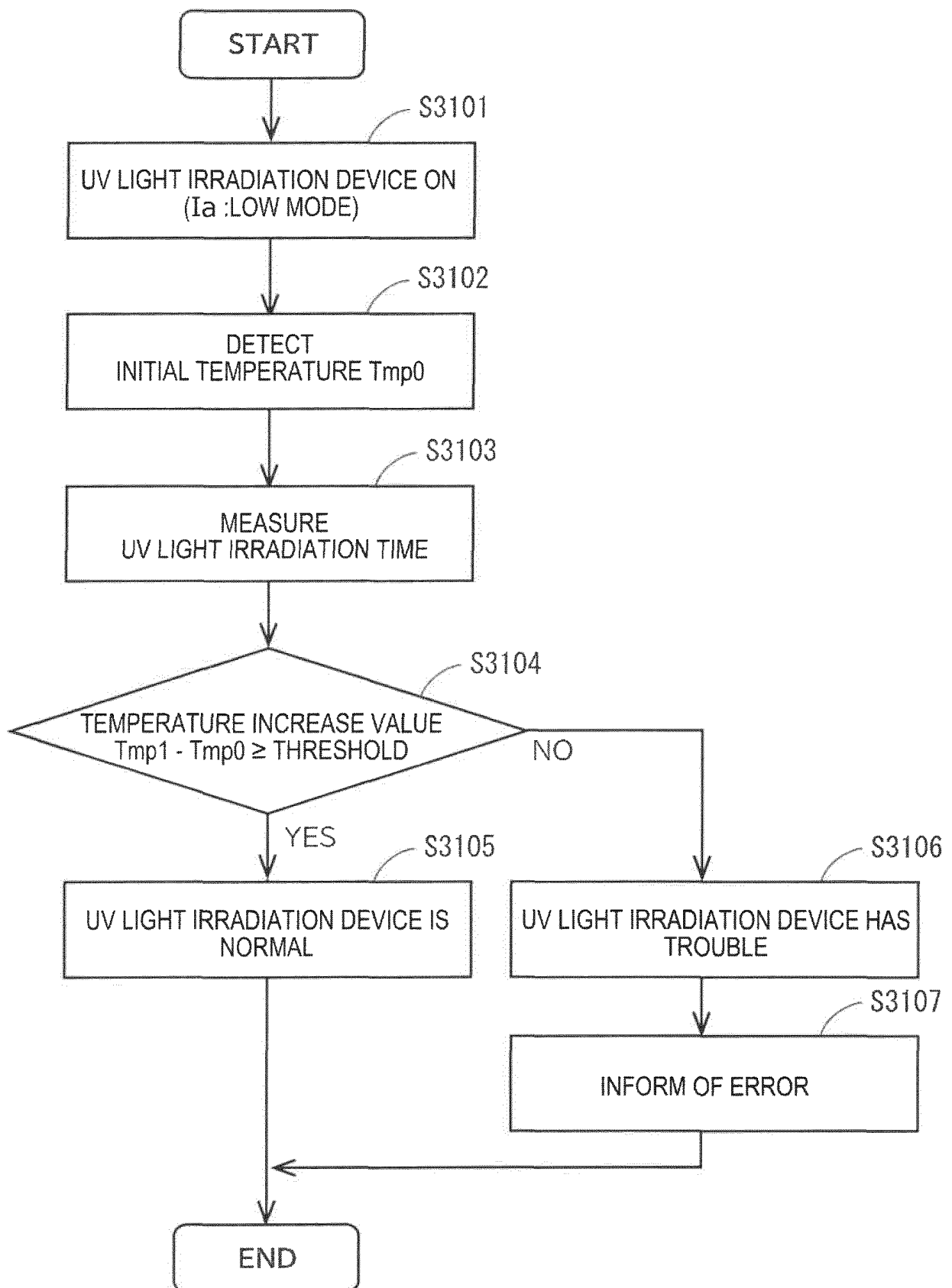


FIG.46

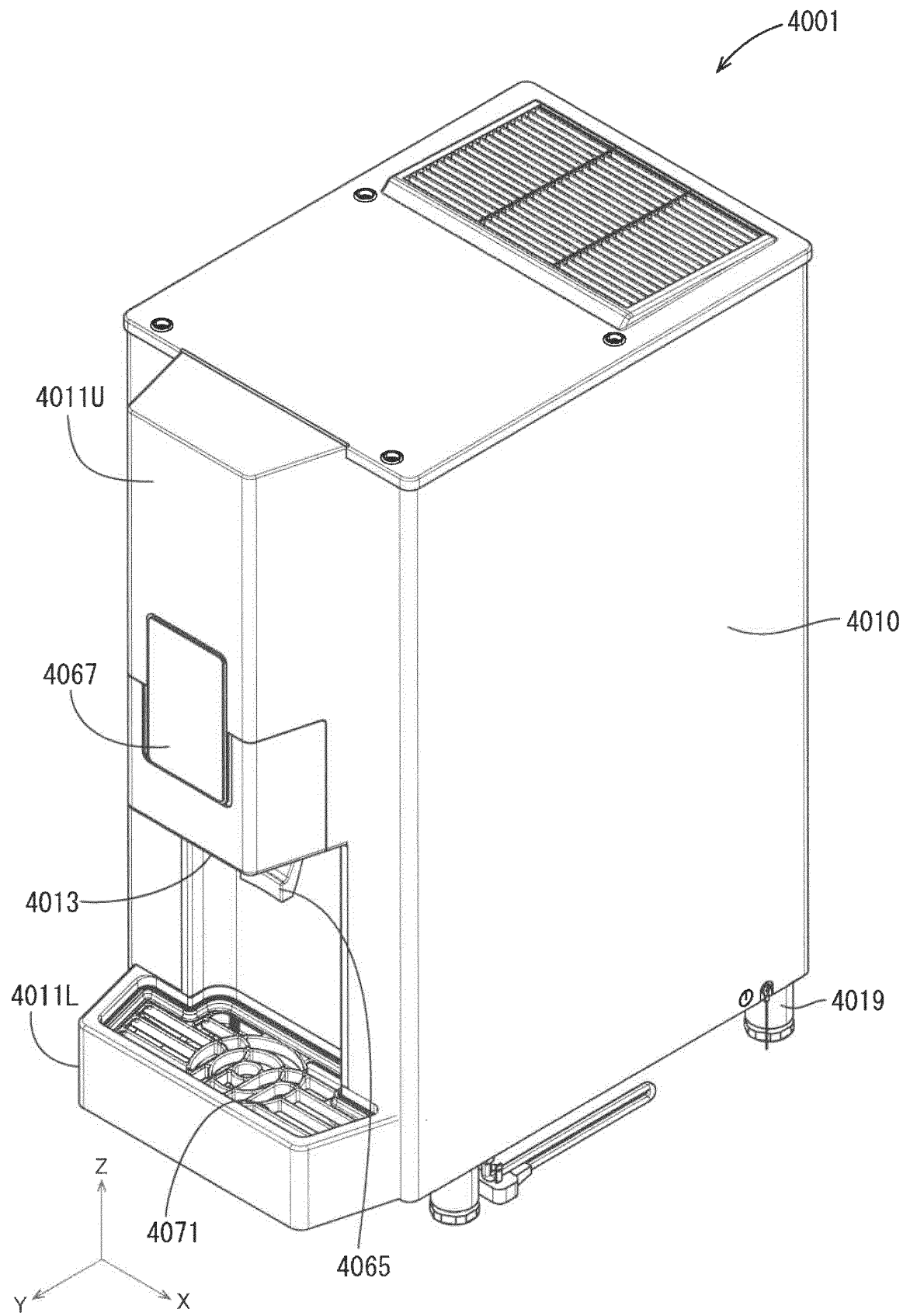


FIG.47

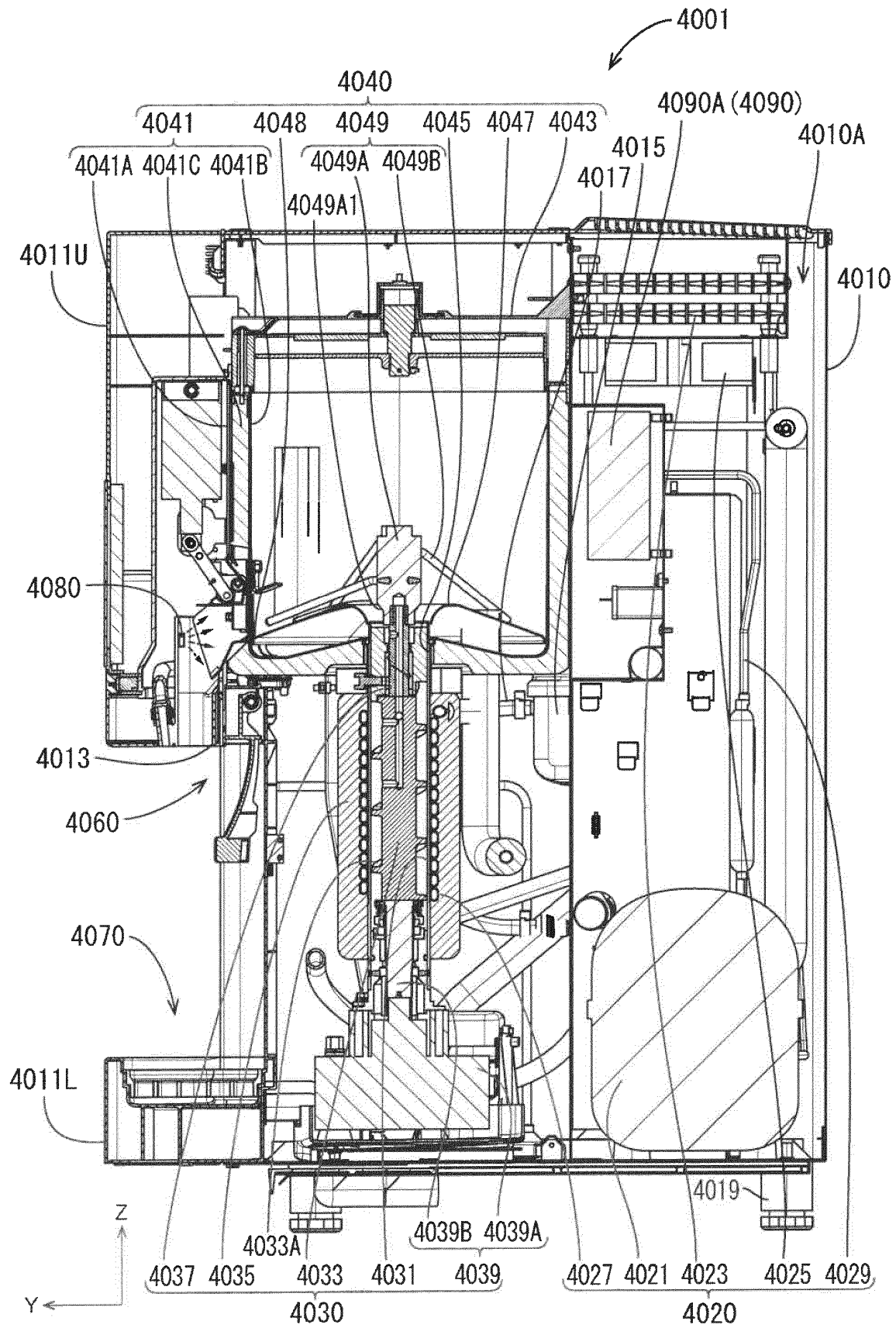


FIG.48

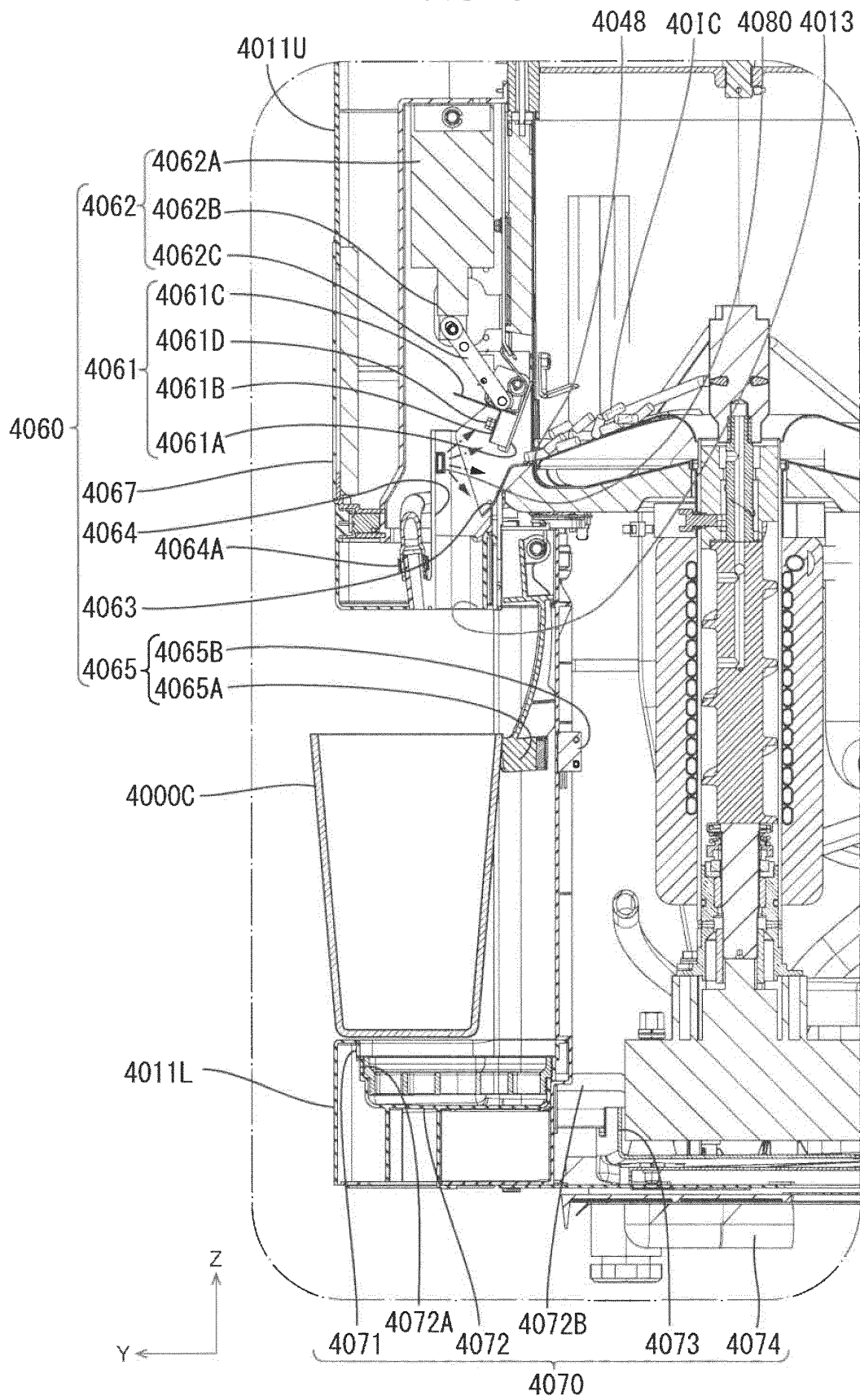


FIG.49

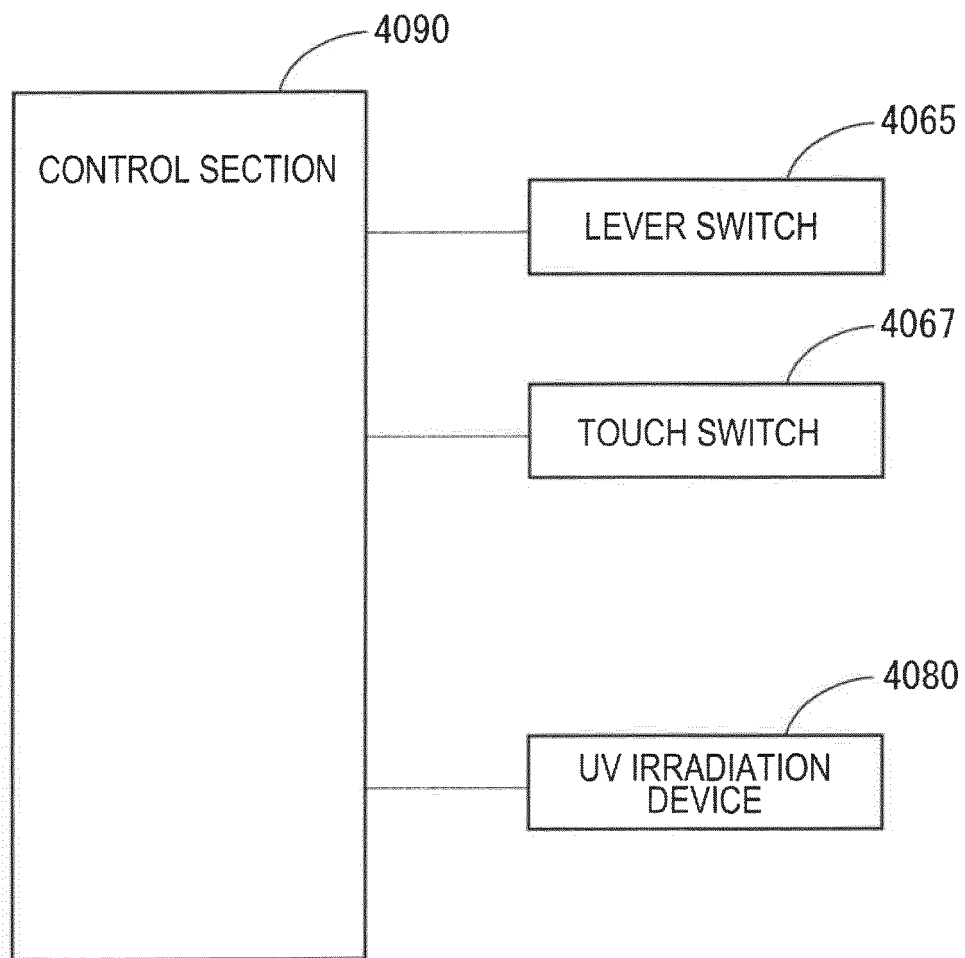


FIG.50

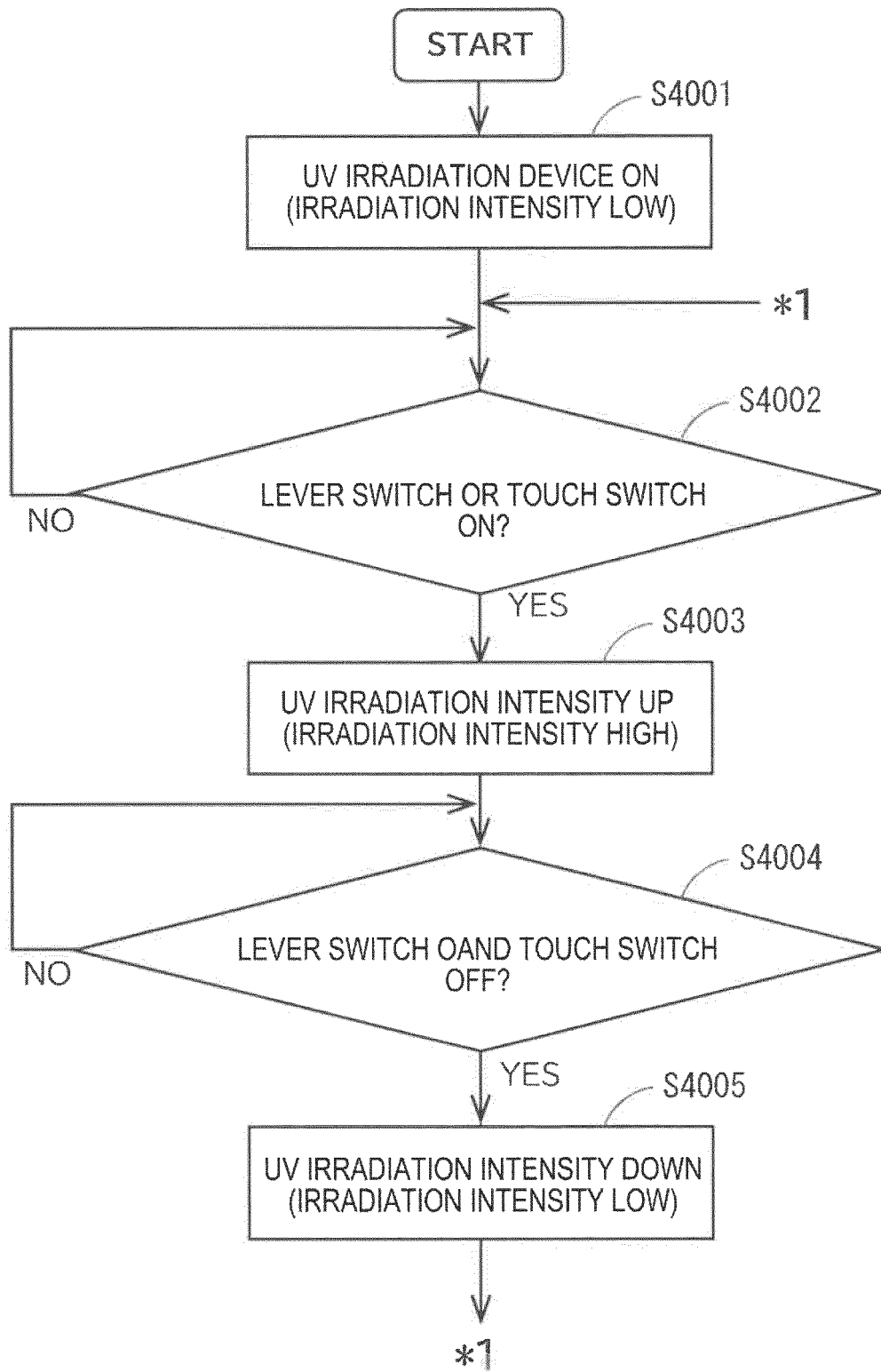


FIG.51

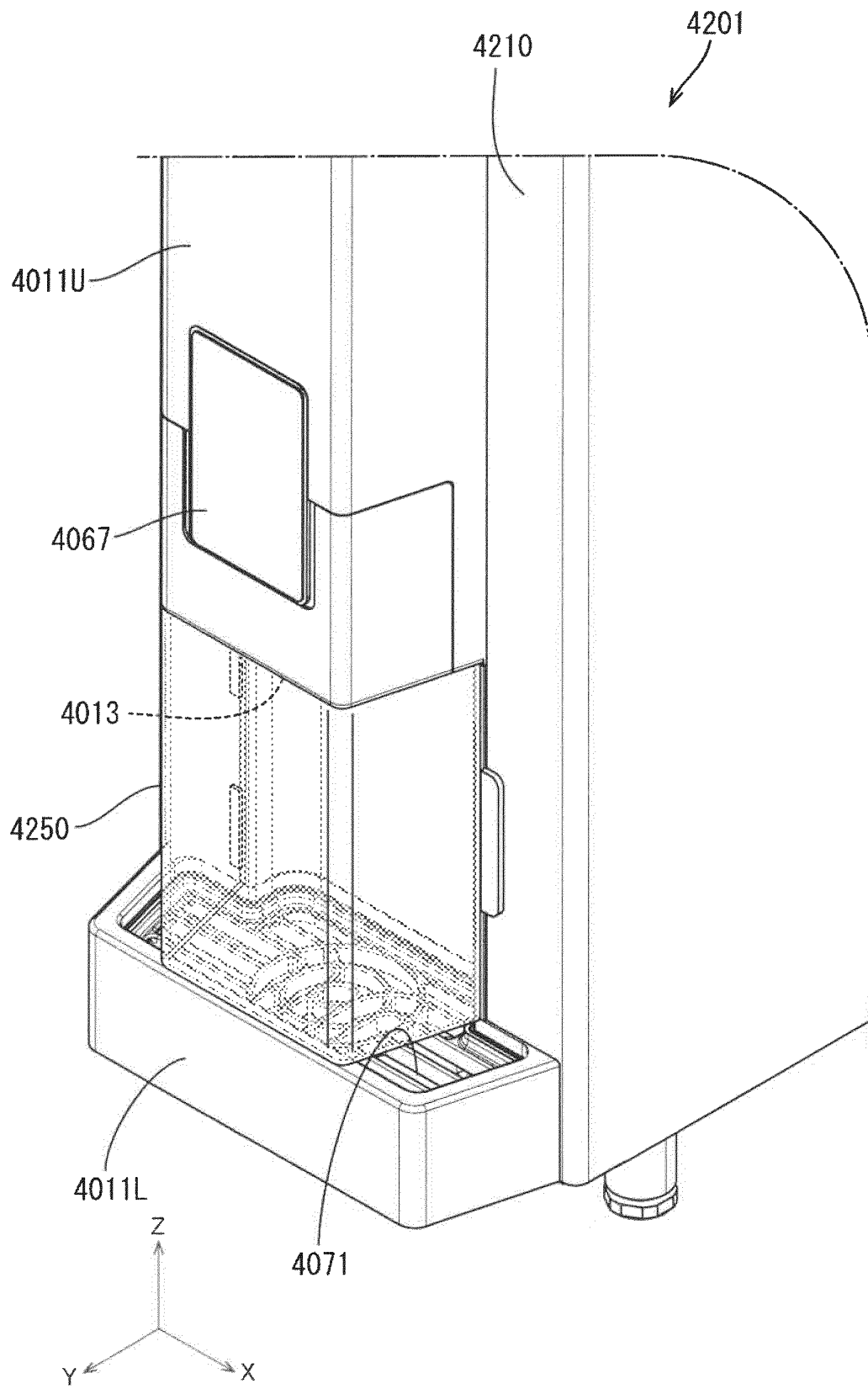


FIG.52

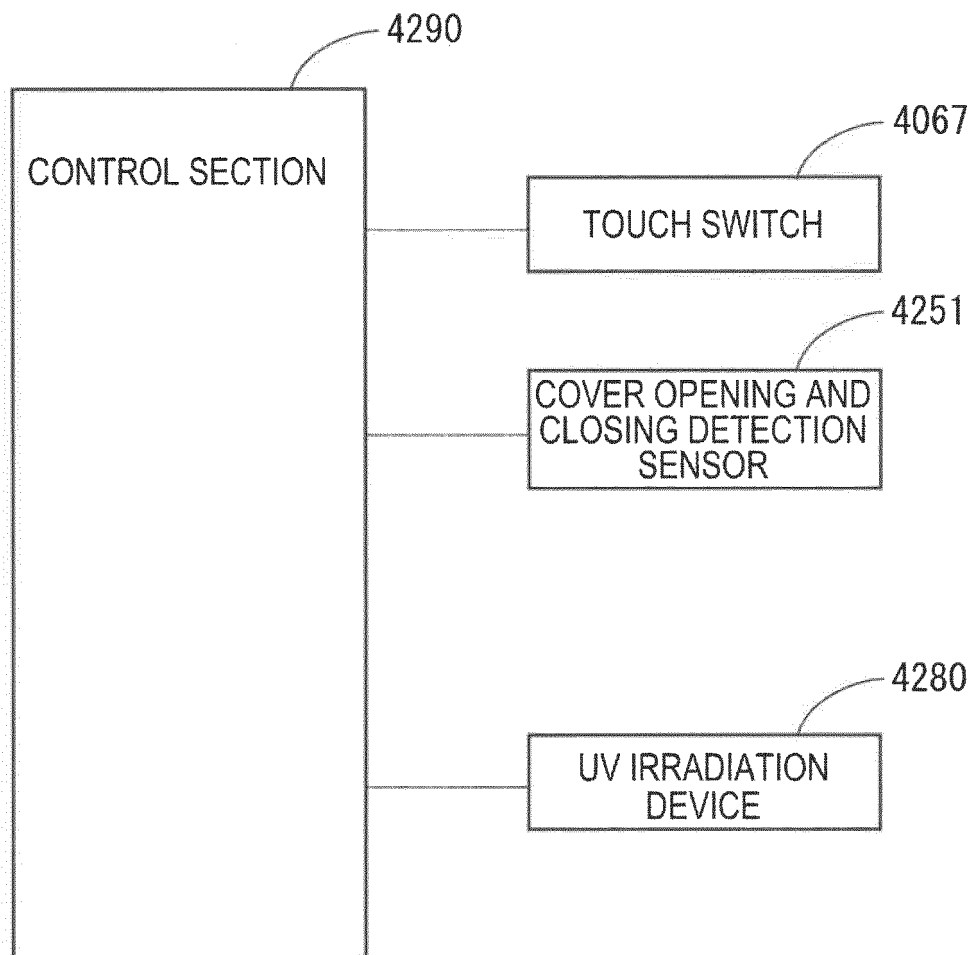


FIG.53

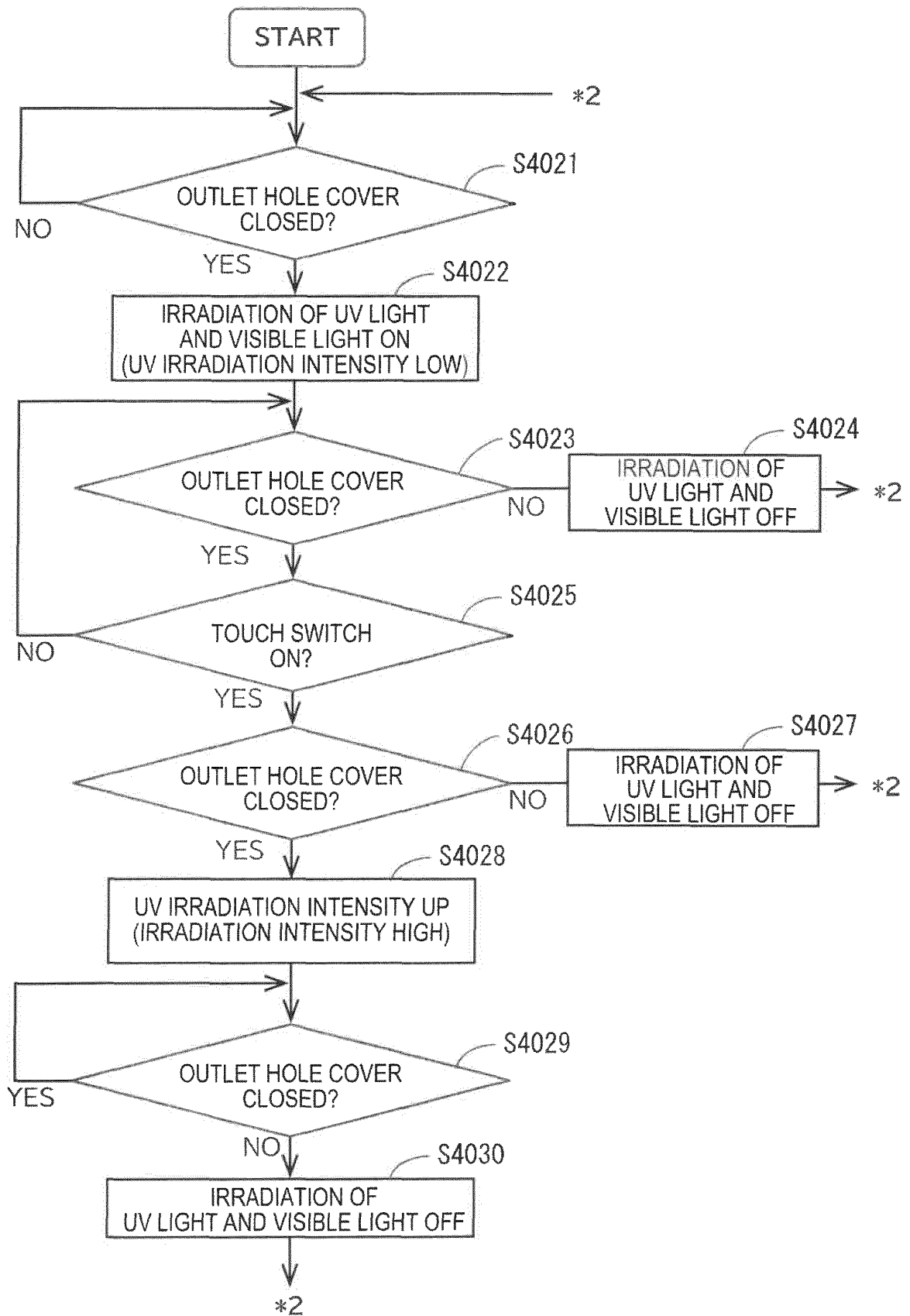


FIG.54

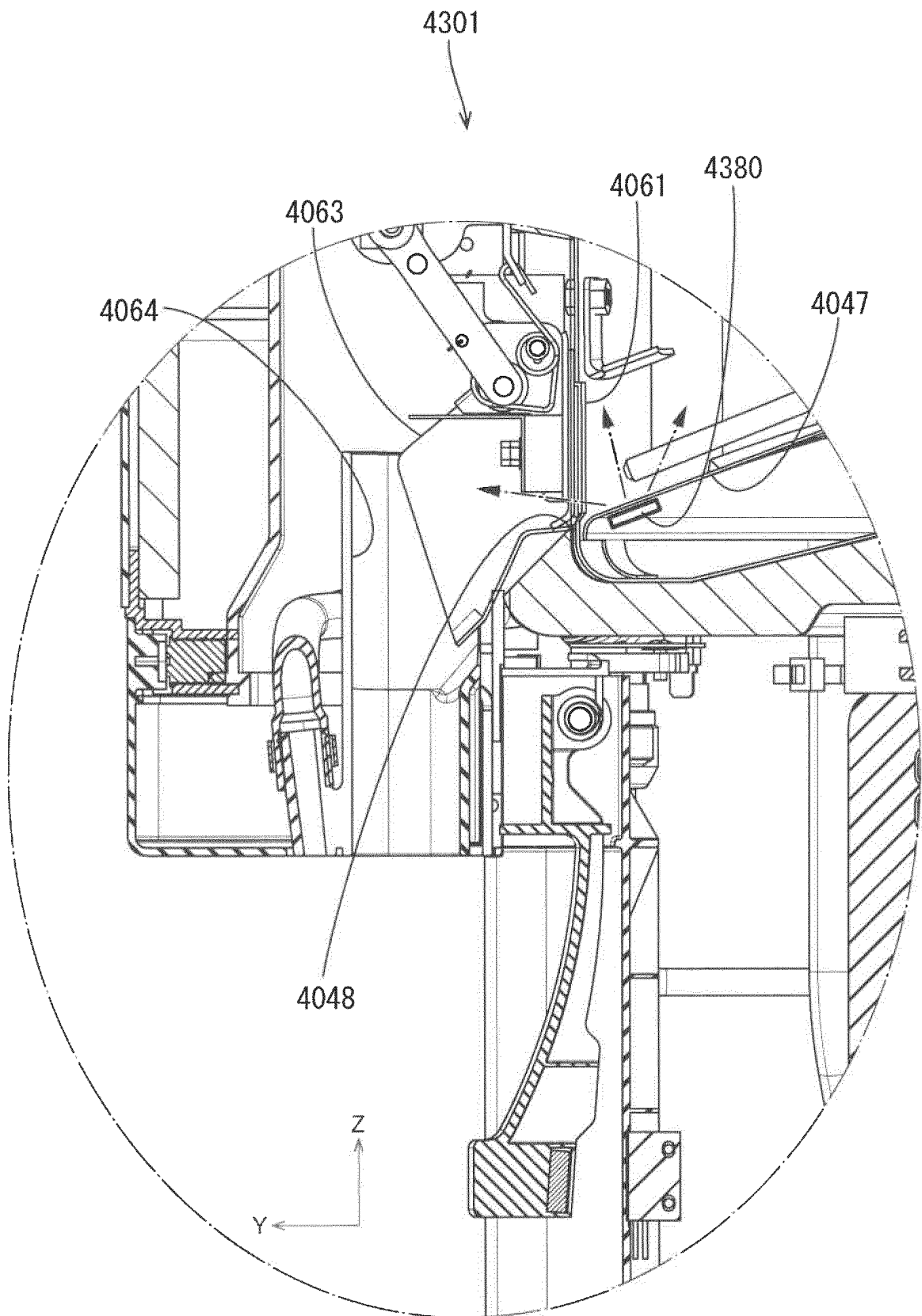


FIG.55

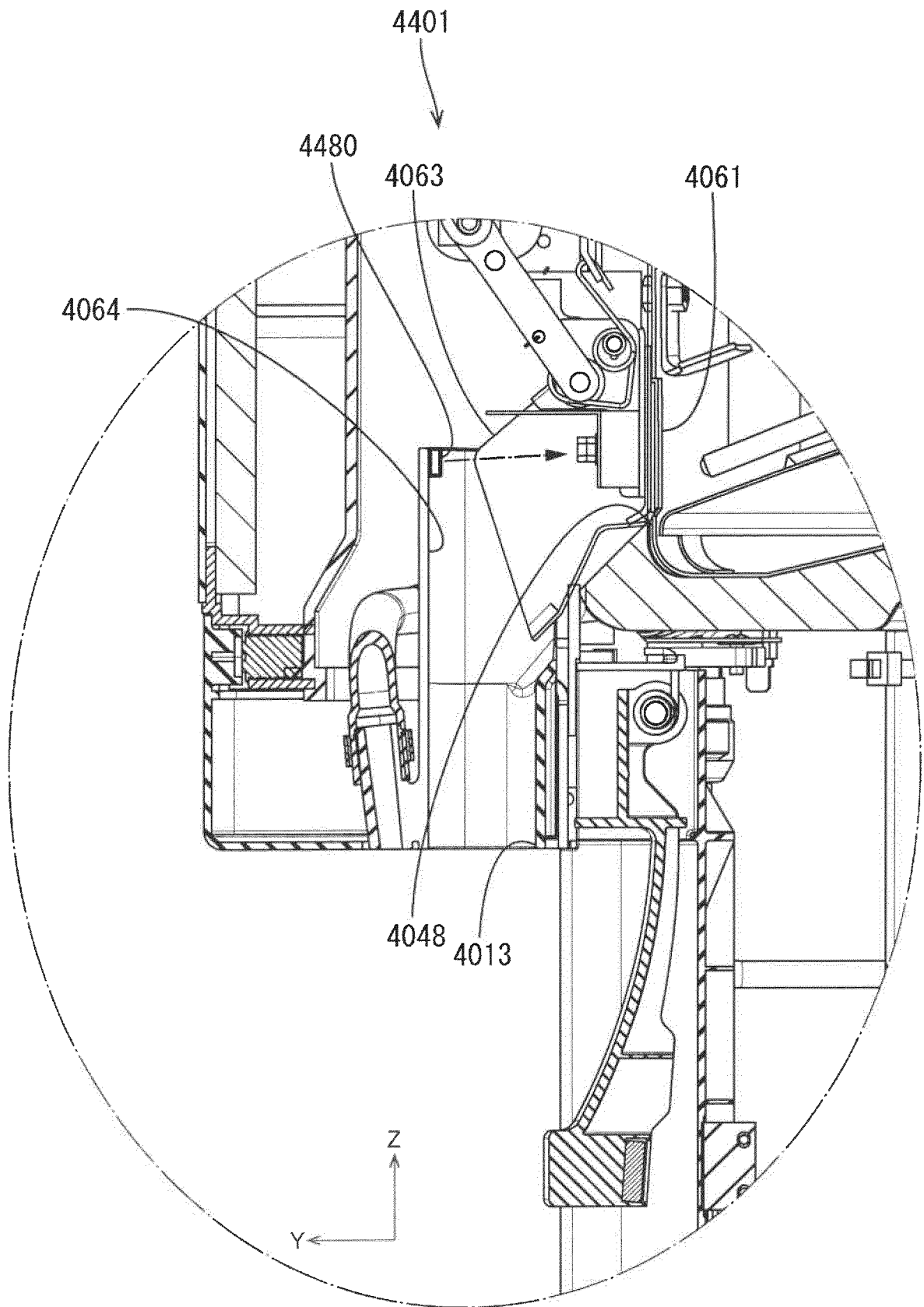


FIG.56

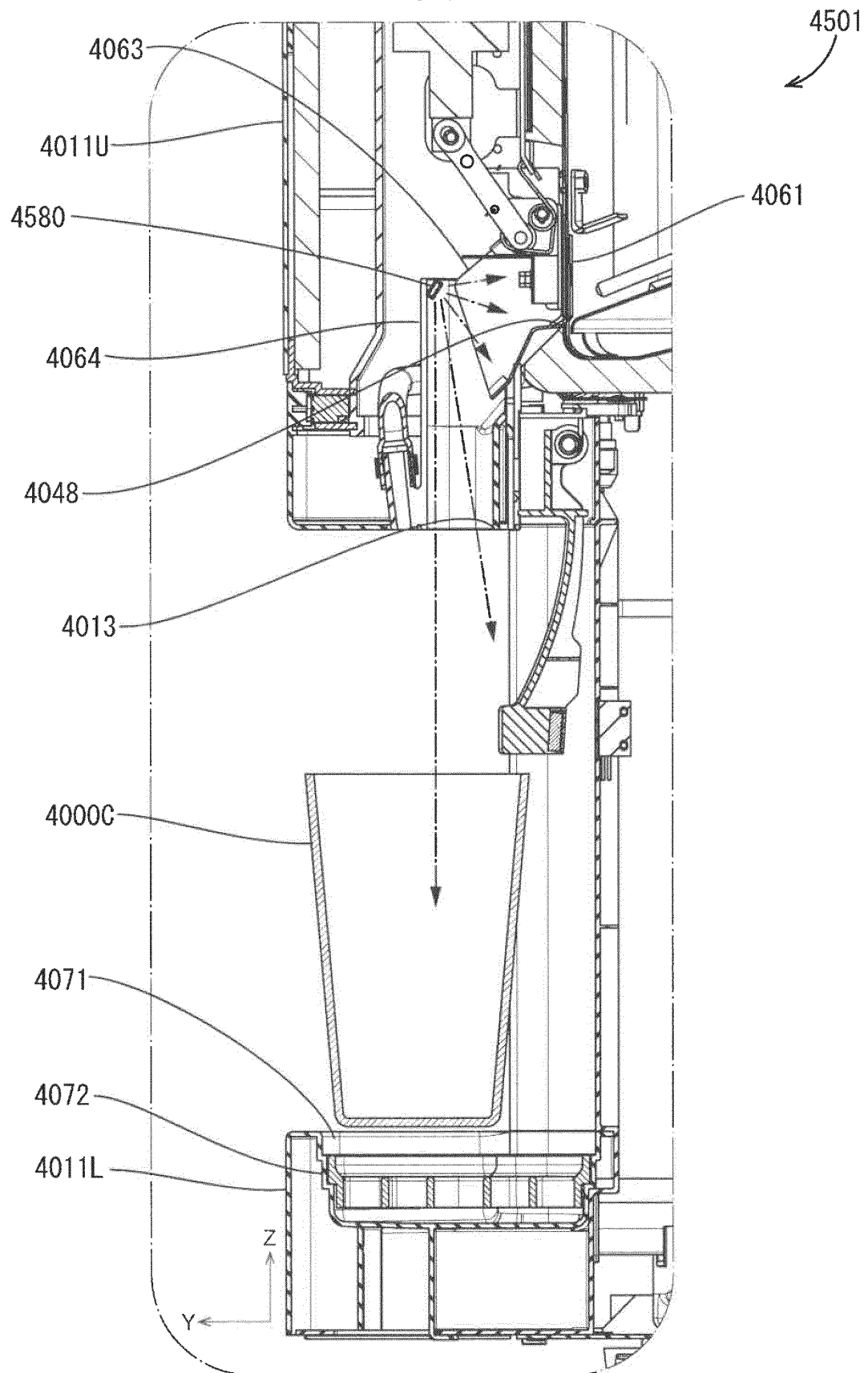


FIG.57

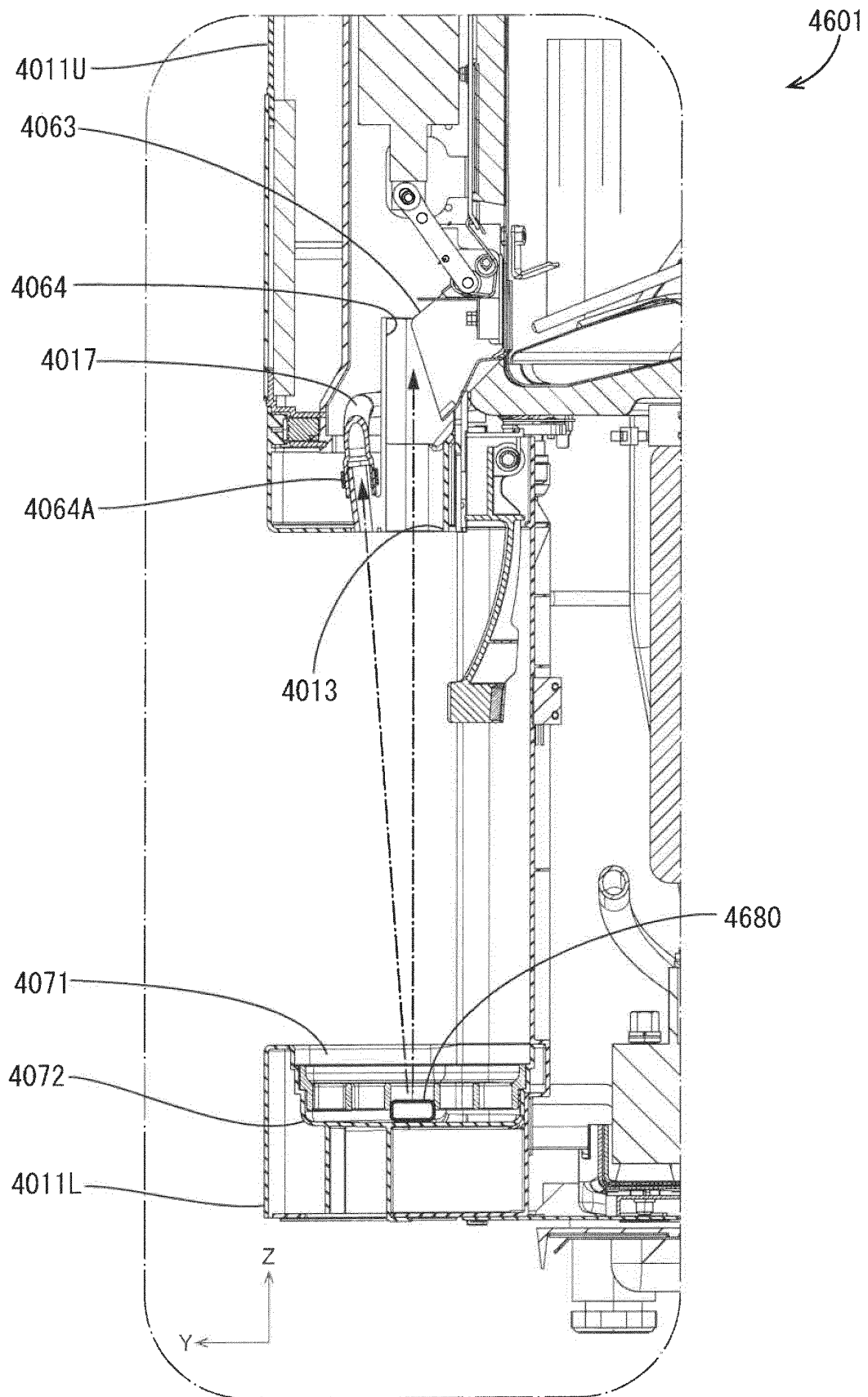


FIG.58

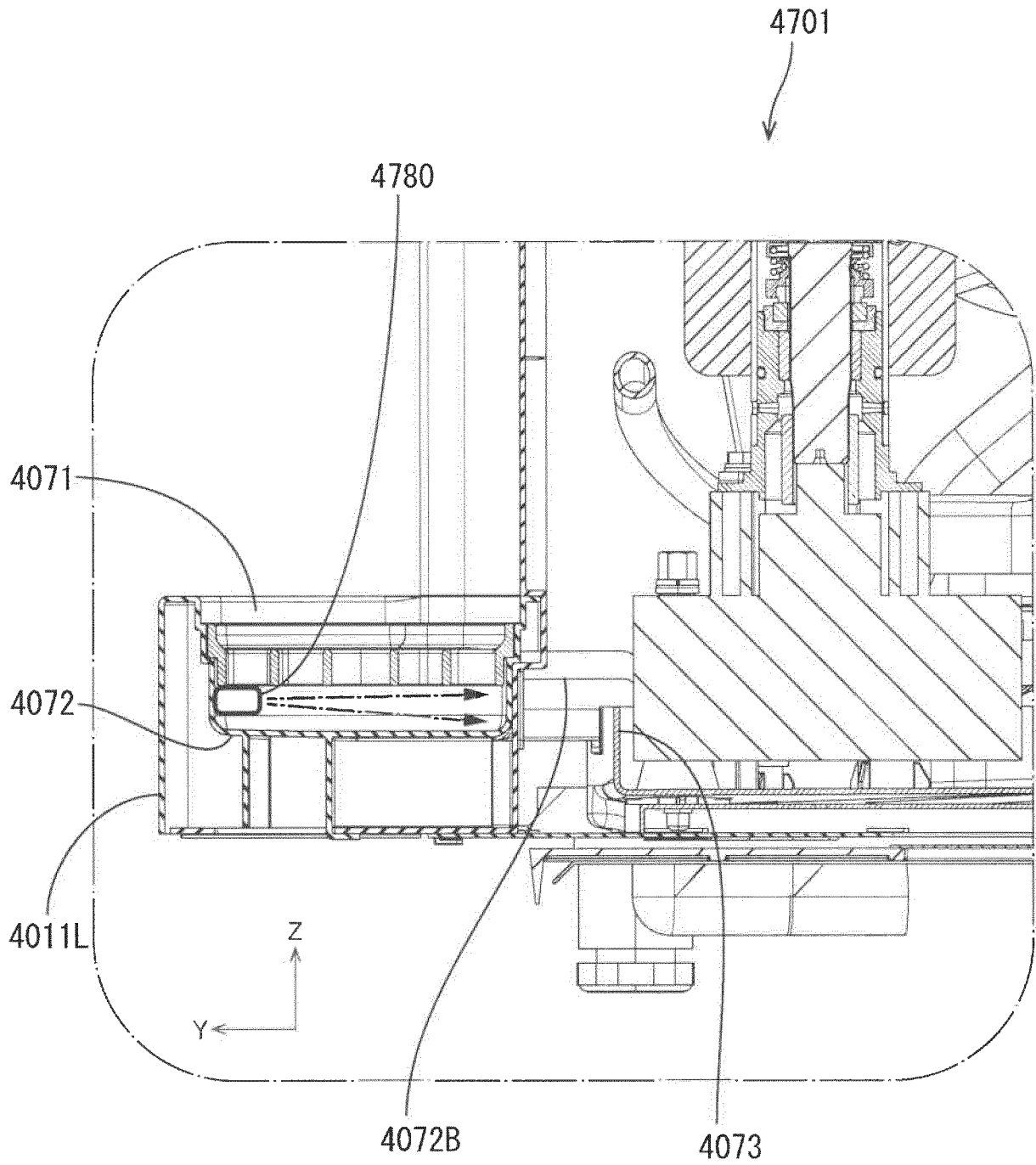
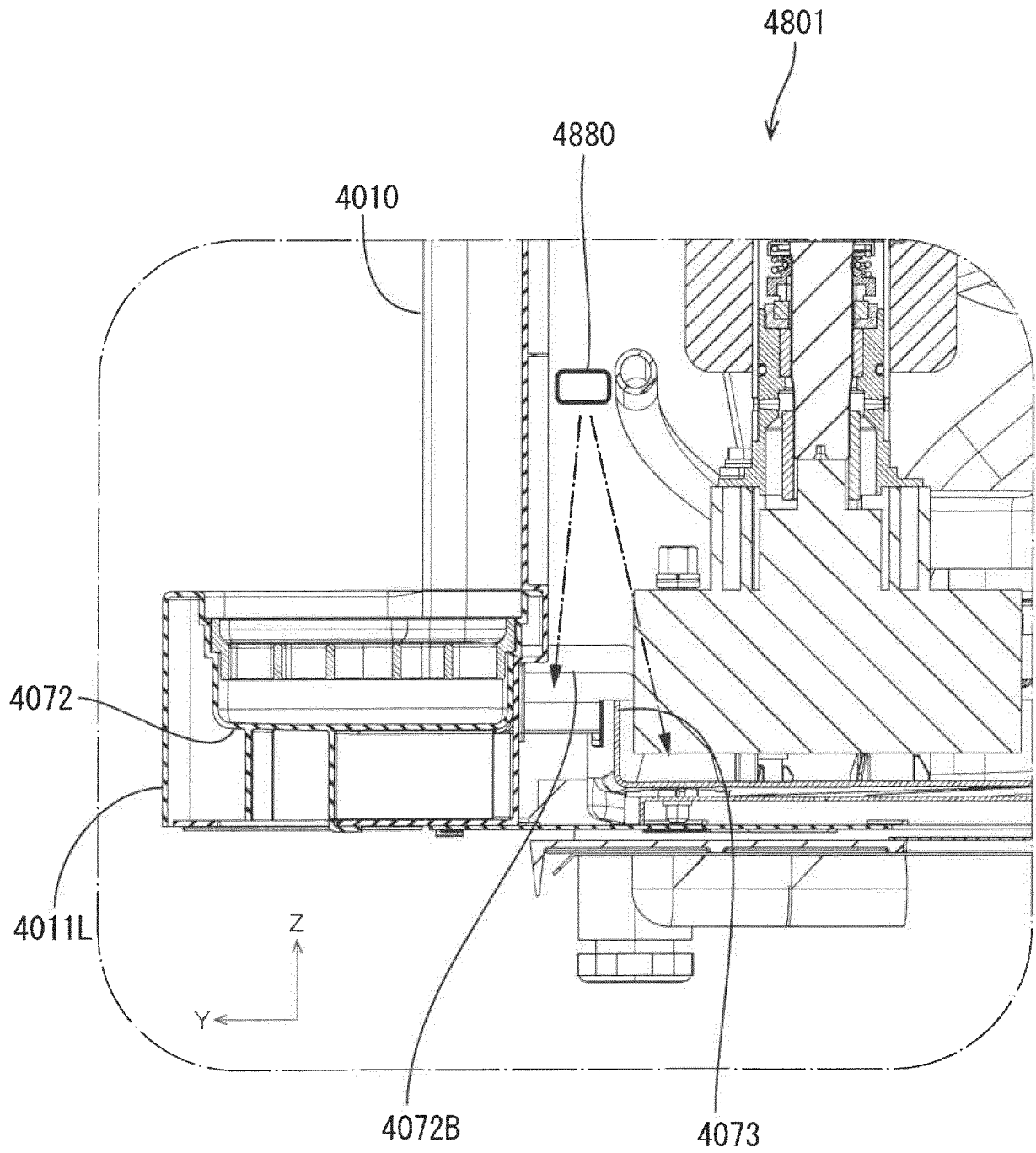


FIG.59



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2021/018458

5	A. CLASSIFICATION OF SUBJECT MATTER F25D 11/00 (2006.01) i; F25C 1/147 (2018.01) i; F25C 1/25 (2018.01) i; F25C 5/187 (2018.01) i FI: F25C1/25 D; F25C1/147 Z; F25C5/187 Z; F25D11/00 102J According to International Patent Classification (IPC) or to both national classification and IPC														
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F25C1/00-5/20; F25D11/00														
15	Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched <table border="0"> <tr> <td>Published examined utility model applications of Japan</td> <td>1922-1996</td> </tr> <tr> <td>Published unexamined utility model applications of Japan</td> <td>1971-2021</td> </tr> <tr> <td>Registered utility model specifications of Japan</td> <td>1996-2021</td> </tr> <tr> <td>Published registered utility model applications of Japan</td> <td>1994-2021</td> </tr> </table>			Published examined utility model applications of Japan	1922-1996	Published unexamined utility model applications of Japan	1971-2021	Registered utility model specifications of Japan	1996-2021	Published registered utility model applications of Japan	1994-2021				
Published examined utility model applications of Japan	1922-1996														
Published unexamined utility model applications of Japan	1971-2021														
Registered utility model specifications of Japan	1996-2021														
Published registered utility model applications of Japan	1994-2021														
	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)														
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT														
	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.												
25	X Y	JP 2020-20562 A (HOSHIZAKI CORPORATION) 06 February 2020 (2020-02-06) paragraphs [0017]-[0034], [0042], fig. 2, 4, 13	1-5 6-8												
	Y A	US 5484538 A (WOODWARD) 16 January 1996 (1996-01-16) column 10, lines 53-56	6 27-28												
30	Y A	JP 2007-3062 A (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) 11 January 2007 (2007-01-11) paragraphs [0019], [0088], fig. 5	7 20-36												
	Y	JP 2020-20561 A (HOSHIZAKI CORPORATION) 06 February 2020 (2020-02-06) paragraphs [0042]-[0043], fig. 1, 14	8												
35	P, X P, A	KR 10-2120039 B1 (ROVEN CO., LTD.) 09 June 2020 (2020-06-09) paragraphs [0027]-[0048], fig. 2-5	9-13, 20 14-19, 21-46												
40	☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.														
45	<table border="0"> <tr> <td>* Special categories of cited documents:</td> <td>"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</td> </tr> <tr> <td>"A" document defining the general state of the art which is not considered to be of particular relevance</td> <td>"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</td> </tr> <tr> <td>"E" earlier application or patent but published on or after the international filing date</td> <td>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</td> </tr> <tr> <td>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</td> <td>"&" document member of the same patent family</td> </tr> <tr> <td>"O" document referring to an oral disclosure, use, exhibition or other means</td> <td></td> </tr> <tr> <td>"P" document published prior to the international filing date but later than the priority date claimed</td> <td></td> </tr> </table>			* Special categories of cited documents:	"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	"A" document defining the general state of the art which is not considered to be of particular relevance	"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	"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family	"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	
* Special categories of cited documents:	"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														
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50	Date of the actual completion of the international search 21 June 2021 (21.06.2021)		Date of mailing of the international search report 29 June 2021 (29.06.2021)												
55	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.

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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.
A	CN 102735652 A (CHEONG, Hweitung) 17 October 2012 (2012-10-17) entire text, all drawings	17-19
A	KR 10-2009-0075068 A (DAEWOO ELECTRONICS CORPORATION) 08 July 2009 (2009-07-08) entire text, all drawings	39

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

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5	Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
	JP 2020-20562 A	06 Feb. 2020	(Family: none)	
	US 5484538 A	16 Jan. 1996	(Family: none)	
10	JP 2007-3062 A	11 Jan. 2007	WO 2006/126584 A1 EP 1887297 A1 paragraphs [0073], [0080], fig. 5 CN 101175954 A	
	JP 2020-20561 A	06 Feb. 2020	(Family: none)	
15	KR 10-2120039 B1	09 Jun. 2020	(Family: none)	
	CN 102735652 A	17 Oct. 2012	KR 10-2012-0110737 A	
	KR 10-2009-0075068 A	08 Jul. 2009	(Family: none)	

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2016006376 A [0005]
- JP 2019219095 A [0005]
- JP 2020020562 A [0005]