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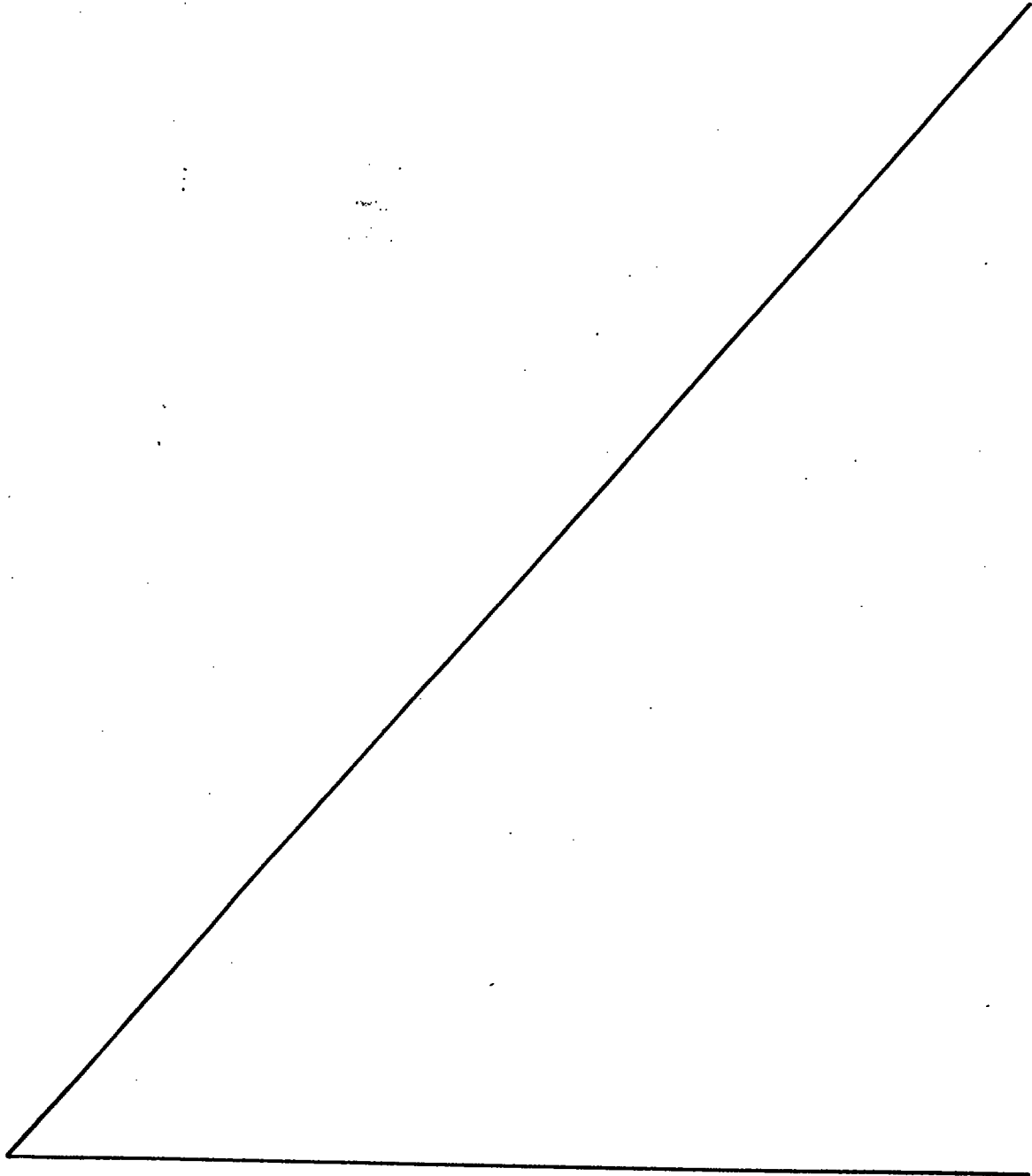
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WATER SUPPLYING APPARATUS FOR AN AUTOMATIC ICE MACHINE

The present invention relates generally to a water supplying apparatus for an automatic ice machine. More particularly, the present invention relates to a water supplying apparatus for an automatic ice machine for supplying



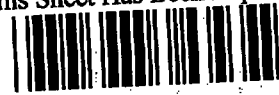


water onto an ice making tray in an ice making compartment of a refrigerator.

[0002]

[PRIOR ART]

Fig. 20 is a fragmentary sectional view of a conventional automatic ice machine which is disclosed in Unexamined Japanese Patent Publication Hei-3-137473. In the drawing, reference numeral 35 designates a water receiving container. The water receiving container 35 is composed of a measuring unit 36, a slit 39 and a receiving portion 35a. A water supply tank 33 including a valve 34a and a cap 34 is arranged in the receiving portion 35a. A pump 47 including a motor 46, an impeller 46, a case 44 and a water supply path 47b is arranged in the measuring unit 36. A mode of operation of the conventional automatic ice machine constructed in the aforementioned manner will be described below. The water stored in the water supply tank 33 is increasingly stored in the water receiving container 35 via the valve 34a, and subsequently, it enters the measuring container 36 through the slit 39. Although the water stored in the measuring unit 36 is pumped up at the time of water supplying, since the supplied water is caused to pass through the slit 39, a quantity of the water which has permeated through the slit 39 is small, resulting in water being supplied from the measuring unit 36 at a constant amount. Since the conventional water supplying apparatus is constructed in the above-described manner, water supplying can be achieved



irrespective of how the water supplying apparatus and the ice making tray are located relative to each other in the vertical positional relationship. However, such apparatus is high in cost sine the water pump is necessitated, and generates noisy sound.

[0003]

In the circumstances as mentioned above, a water supplying apparatus for an automatic ice machine as illustrated in Fig. 21 is proposed as disclosed in Unexamined Japanese Patent Publication Hei-3-221769. In the drawing, reference numeral 3 designates an ice making compartment, reference numeral 5 designates a refrigerating compartment, reference numeral 8 designates an ice making tray, reference numeral 12 designates a water supplying apparatus, reference numeral 13 designates a water tank, reference numeral 14 designates a water storing container, reference numeral 15 designates a water receiving section, reference numeral 16 designates a water storing section, reference numeral 18 designates an inflow port, reference numeral 20 designates an outflow port, reference numeral 23 designate an electromagnetic solenoid, reference numeral 25 designates an inflow valve, reference numeral 26 designates an outflow valve, and reference numeral 27 designates a water supplying pipe. The water supplying apparatus 12 is arranged in the refrigerating compartment 5 and the ice making tray 8 is disposed in the ice making compartment 3 at the position lower than the water supplying apparatus 12



so that the water supplying apparatus 12 is communicated with the ice making tray 8 via the water supplying pipe 27. The water supplying apparatus 12 is substantially composed of the water tank 12, the water receiving container 14 and the water receiving section 15. Especially, upper and lower holes are formed on the water storing container 14, and the water supplying apparatus 12 includes as essential components the upper inflow port 18, the lower outflow port 20, the inflow valve 25 for closing the inflow port 18 therewith and the outflow valve 26 for closing the outflow port 20 therewith. The inflow port 18 is communicated with the water receiving section 15, and the outflow port 20 is communicated with the water supply pipe 27. The inflow valve 25 and the outflow valve 26 are operatively connected to each other, and both the valves 25 and 26 are electrically connected to the electromagnetic solenoid 23 disposed above the outflow valve 26 in such a manner that when the inflow port 18 is opened, the outflow port 20 is closed with the outflow valve 25 and when the inflow port 18 is closed, the outflow port 20 is opened. These operations can be performed by activating the electromagnetic solenoid 23.

[0004]

Next, a mode of operation of the water supplying apparatus 12 constructed in the aforementioned manner will be described below. The water discharged from the water tank 19 is once stored in the water receiving section 16, and subsequently, it



is introduced into the water storing section 16 via the inflow port 18. At this time, since the inflow valve 25 is opened and the outflow valve 26 is kept closed, water is continuously supplied into the water storing section 16 until the latter is fully filled with water. When the thus stored water is to be delivered to the ice making tray 8, the electromagnetic solenoid 23 is activated so that the outflow valve 26 is opened and the inflow valve 29 is closed. At this time, only the water stored in the water storing section 16 is caused to flow into the ice making tray 8 via the water supply pipe 27. Thus, water supplying can be achieved at a constant amount.

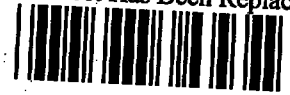
[0005]

[SUBJECTS TO BE SOLVED BY THE INVENTION]

With each of the conventional water supplying apparatuses constructed in the above-described manner, the water stored in the water receiving section is exposed to the environmental air so that various kinds of bacilli floating in the air are adsorptively included in the stored water. Thus, when the stored water is kept still for a long time, there arise problems that the water tank and other components are covered with a film or layer of slime, and moreover, there is a high possibility that a sanitary quality of water stored in the water receiving section is degraded.

[0006]

In addition, each conventional water supplying apparatus has another problems that the solenoid is wetted with the water



which may flow along the rear surface of a conical member of the inflow valve, a frost appears on some part of the water supplying apparatus due to leakage of cold air from the ice making compartment to the refrigerating compartment under the influence of air stream, the open type water supply path is contaminated with foreign materials, and moreover, the absence of water fails to be detected.

[0007]

Further, with each conventional water supplying apparatus, there arises a problem that the water stored in the water receiving section is soaked with an odor specific to a foodstuff stored in the refrigerator. With respect to the water supplying apparatus having a pump used therefor as disclosed in Unexamined Japanese Patent Publication Hei-3-137473, there arise problems that sound generated by rotation of the pump at the time of water supplying is noisy, the rotational speed of the pump fluctuates, and a measuring container is held in the inclined state due to the inclination of the refrigerator induced at the time of installation, causing the surface level of water in the measuring container to vary with the result that water supplying fails to be achieved at a constant rate.

[0008]

The present invention has been made in consideration of the aforementioned problems and its object resides in providing a water supplying apparatus for an automatic ice machine wherein



the arrangement of a water receiving section is eliminated so that there does not arise a malfunction that the water stored in a water receiving section is exposed to the environmental air, causing various kinds of bacilli floating in the air to be adsorptively included in the water.

[0009]

Other object of the present invention is to provide a water supplying apparatus for an automatic ice machine wherein a solenoid section is not wetted with water at all, cold air does not flow from an ice making compartment to a refrigerating compartment, an open type water supply path is not contaminated with foreign materials, and any absence of water can be detected without fail.

[0010]

Another object of the present invention is to provide a water supplying apparatus for an automatic ice machine wherein the arrangement of a water receiving section is eliminated so as not allow the water stored in the water receiving section to be exposed to the environmental air, various kinds of bacilli floating in the air and unpleasant odor are not adsorptively included in water, and moreover, water supplying can be achieved at a constant rate at all times while generating a low level of sound.

[0011]

[MEANS FOR SOLVING THE SUBJECTS]



The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 1 of the claim clause is characterized in that the water supplying apparatus comprises a water tank disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, and driving means disposed below the water tank for driving the valve assembly in order to open the outflow valve and close the inflow valve when the water stored in a measuring chamber of the measuring unit in the water tank is supplied onto the ice making tray in the ice making compartment, wherein the driving means includes sealing means in the vicinity of the driving means so as to prevent the driving means from being wetted with the water stored in the water tank.

[0012]

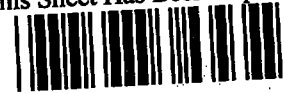
The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 2 of the claim clause is characterized in that the water supplying apparatus comprises a measuring unit disposed in an



accommodating chamber different from the ice making compartment and located above the latter and including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, a water tank, and driving means disposed for driving the valve assembly in order to open the outflow valve and close the inflow valve when the water stored in a measuring chamber of the measuring unit is supplied onto the ice making tray in the ice making compartment, wherein a door switch mounted on a door of a refrigerator is opened or closed in operative association with the driving means such that the outflow valve is closed when the door is opened.

[0013]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 3 of the claim clause is characterized in that the water supplying apparatus comprises a measuring unit disposed in an accommodating chamber different from the ice making compartment and located above the latter, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow,



a water tank, and driving means disposed for driving the valve assembly to supply the water stored in a measuring chamber of the measuring unit through the outflow hole by opening the latter, wherein a water supply path extending from the accommodating chamber to the ice making compartment is designed in the form of an open type water supply path of which outlet port is opened or closed by a float valve.

[0014]

The water supplying apparatus for an automatic ice machine as defined by claim 4 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 1 of the claim clause is improvably modified in such a manner that the driving means for driving the valve assembly is dislocated in the horizontal direction so that the outflow valve is opened or closed in the upward/downward direction via a connecting mechanism.

[0015]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 5 of the claim clause is characterized in that the water supplying apparatus comprises a water tank different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow



hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, and driving means disposed for opening and closing the outflow valve in order to supply the water stored in a measuring chamber of the measuring unit onto the ice making tray through the outflow hole by opening the latter, wherein a flexible member molded of a rubber and adapted to be displaced in operative association with the driving means is fitted to a part of an open type water supply path extending from the accommodating chamber to the ice making compartment.

[0016]

The water supplying apparatus for an automatic ice machine as defined by claim 6 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 5 of the claim clause is improvably modified in such a manner that a water reservoir is disposed at the intermediate part of the water supply path extending from the accommodating chamber to the ice making compartment so as to prevent cold air from leaking therefrom.

[0017]

The water supplying apparatus for an automatic ice machine as defined by claim 7 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 5 of the claim clause is improvably modified in such a manner that the measuring chamber or the water tank and the



open type water supply path are sealably arranged so as to prevent cold air from leaking therefrom.

[0018]

The water supplying apparatus for an automatic ice machine as defined by claim 8 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 5 of the claim clause is improvably modified in such a manner that a cleaning tray having the substantially same configuration as that of the open type water supply path is placed on the open type water supply path so that it is fitted to one end of the flexible member molded of a rubber.

[0019]

The water supplying apparatus for an automatic ice machine as defined by claim 9 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 5 of the claim clause is improvably modified in such a manner that a magnetic member is displaceably received in the measuring chamber.

[0020]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 10 is characterized in that the water supplying apparatus comprises a water tank assembly disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein,



the measuring unit including a valve assembly comprising an inflow valve and an outflow valve in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, driving means disposed for opening or closing the outflow valve in order to supply the water stored in a measuring chamber of the measuring unit onto the ice making tray in the ice making compartment through the outflow hole by opening the latter, a cap having the outflow hole formed thereon, an inner casing having the measuring chamber threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case fitted to the inflow hole side of the inner case and including the inflow valve molded of an elastic material such as a rubber or the like, an air venting hole formed at the upper part of the inner case and a water cleaning filter secured thereto, and a cooperating shaft held by the cap and the upper case to open and close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction, the cooperating shaft including the outflow valve molded of an elastic material such as a rubber or the like.

[0021]

The water supplying apparatus for an automatic ice machine arranged in ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 11 of the claim clause is characterized in that the water



supplying apparatus comprises a water tank assembly disposed in an accommodating chamber different from the ice making compartment and located above the latter and including an inflow/ outflow valve for closing an inflow hole and an outflow hole therewith with a measuring unit incorporated therein in such a manner as to close an outflow valve of the inflow/outflow valve at the time of water inflow and closing an inflow valve of the same at the time of water outflow, driving means disposed for opening and closing the inflow/outflow valve in order to supply the water stored in a measuring chamber of the measuring unit onto the ice making tray in the ice making compartment through the outflow hole by opening the latter, a cap having the outflow hole formed thereon, an inner casing having the cap threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case disposed above the inner case and having an air venting hole formed thereon and a cleaning water filter secured thereto, and a cooperating shaft held by the cap and the upper case so as to allow it to be slidably displaced in the upward/downward direction, wherein the inflow/outflow valve fitted onto the cooperating shaft is molded of an elastic material such as a rubber or the like in order to open or close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction.

[0022]



The water supplying apparatus for an automatic ice machine as defined by claim 12 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 10 or claim 11 of the claim clause is improvably modified in such a manner that the ceiling plate of the inner case is inclined such that its height increases toward the air vent.

[0023]

The water supplying apparatus for an automatic ice machine as defined by claim 13 is characterized in that the water supplying apparatus for an automatic ice machine as defined by claim 10 or claim 11 is improvably modified in such a manner that the air vent hole is designed in the form of a cylindrical air vent standing upright from the upper case.

[0024]

[MODE OF OPERATION]

With the water supplying apparatus for an automatic ice machine as defined by claim 1 of the claim clause, since the measuring chamber is disposed in the completely closed water tank, there does not arise a malfunction that various kinds of bacilli floating in the air are adsorptively included in the water stored in the water tank. Thus, there is few possibility that the water tank and other components are covered with a film or layer of slime, and moreover a sanitary quality of the water stored in the water tank is degraded. In addition, cleaning and maintenance services can easily be performed with the water supplying apparatus.



[0025]

With the water supplying apparatus for an automatic ice making nit as defined by claim 2 of the claim clause, safety of the water supplying apparatus can be improved, and there is no possibility that the water tank is damaged or injured when it is forcibly taken out from the water tank accommodating chamber.

[0026]

With the water supplying apparatus for an automatic ice machine as defined by claim 3 of the claim clause, water supplying can be achieved not only when the water supplying apparatus and the ice making tray are positionally offset in the horizontal direction but also when it is difficult to extend a water supplying pipe around the water supply apparatus and other components. Further, there does not arise a malfunction that cold air leaks from the region between the ice making compartment and the refrigerating compartment.

[0027]

With the water supplying apparatus for an automatic ice machine as defined by claim 4 of the claim clause, there is few possibility that the solenoid is wetted with water drops. Consequently, reliability of the water supplying apparatus can be improved with the water supplying apparatus.

[0028]

With the water supplying apparatus for an automatic ice machine as defined by claim 5 of the claim clause, since the



solenoid and the open type water supply path are sealably arranged relative to each other using a flexible member molded of a rubber, there is no possibility that the solenoid is wetted with water. Consequently, there does not arise a malfunction that actuation of the solenoid is interrupted by the invasion of the water in the solenoid.

[0029]

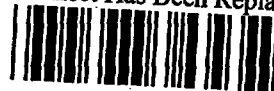
With the water supplying apparatus for an automatic ice machine as defined by claim 6 of the claim clause, since the water reservoir is arranged at the intermediate part of the water supply path, there do not arise malfunctions that cold air leaks from the water supplying apparatus, and moreover, frosting is recognized around the water supplying apparatus.

[0030]

With the water supplying apparatus for an automatic ice machine as defined by claim 7 of the claim clause, since the water tank and the water supply path are sealably arranged relative to each other by employing the sealing mechanism, there do not arise malfunctions that cold air leaks from the water supplying apparatus, and moreover, frosting is recognized around the water supplying apparatus.

[0031]

With the water supplying apparatus for an automatic ice machine as defined by claim 8 of the claim clause, since the cleaning tray having the substantially same configuration as that of the open type water supply path is placed on the water



supply path, cleanability of the water supply apparatus can be improved.

[0032]

With the water supplying apparatus for an automatic ice machine as defined by claim 9 of the claim clause, the absence of water can be detected when it is found that the lead switch is turned on for a time longer than a predetermined one.

[0033]

With the water supplying apparatus for an automatic ice machine as defined by claim 10 of the claim clause, since the conventional water receiving section is eliminated and the measuring chamber is disposed in the completely closed water tank, there does not arise malfunctions that the water tank and other components are covered with a film or layer of slime, and moreover, a sanitary quantity of the water stored in the water tank is deteriorated without any soaking of foodstuff and water with unpleasant odor. In addition, since no pump is employed for the water supplying apparatus but water is supplied by activating the solenoid, any noisy sound attributable to rotation of the conventional pump is not generated with the water supplying apparatus. Consequently, the water supplying apparatus can practically be used at a low level of noise. Since both the inflow valve and the outflow valve are molded of an elastic material such as a rubber or the like, it is assured that the inflow valve is brought in close contact with the inflow hole when the water stored in the

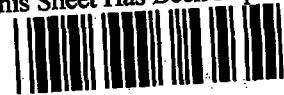


measuring chamber is supplied onto the ice making tray in the ice making compartment without any leakage of water in the measuring chamber. Thus, water supplying can be achieved at a constant rate at all times.

When the actuating shaft of the solenoid is firmly held in the course of its working stroke for some reason while the solenoid is activated, it usually vibrates and generates a groaning sound. However, since the inflow valve is molded of an elastic material, it is geometrically deformed when it is brought in close contact with the inflow hole in the course of the working stroke of the actuating shaft of the solenoid. Thus, the actuating shaft of the solenoid completes its normal working stroke without generation of vibration and groaning sound. Further, in case that a small amount of water is stored in the water supply tank, there does not arise a malfunction that the inflow valve is floated up in the water supply tank.

[0034]

With the water supplying apparatus for an automatic ice machine as defined by claim 11 of the claim clause, since the inflow valve and the outflow valve are integrated with each other in the form of an inflow/outflow valve which in turn is fitted onto the cooperating shaft, the water supplying apparatus can be fabricated using a small number of components at an inexpensive cost while preventing any water leakage due to incorrect fitting of the inflow valve as arising with the



water supplying apparatus as defined by claim 1 of the claim clause.

[0035]

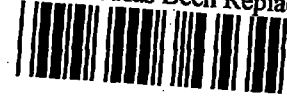
With the water supplying apparatus for an automatic ice machine as defined by claim 12 of the claim clause, since the ceiling plate of the inner case is inclined such that its height gradually increases toward the air vent, no air remains below the ceiling plate of the inner case after the measuring chamber is filled with the water which has been introduced therein through the inflow hole. Thus, water supplying can be achieved at a constant rate at all times.

[0036]

With the water supplying apparatus for an automatic ice machine as defined by claim 13 of the claim clause, since the air venting hole on the ceiling plate of the upper case is designed in the form of a cylindrical air vent standing upright therefrom, all water is caused to permeate through the water cleaning filter. Thus, the water supplying apparatus can exhibit an excellent water cleaning effect.

[0037]

[EMBODIMENTS]



Embodiments of the present invention will now be described, by way of example, and with reference to Fig. 1 to Fig. 19 of the accompanying drawings, in which:-

Fig. 1 is a whole front view of a refrigerator including a water supplying apparatus for an automatic ice machine constructed according to a first embodiment of the present invention.

Fig. 2 shows by way of sectional views the whole structure as well as the detailed structure of the water supplying apparatus for an automatic ice machine constructed according to the first embodiment of the present invention.

Fig. 3 is a schematic view of a control section for the water supplying apparatus for an automatic ice machine constructed according to the first embodiment of the present invention.

Fig. 4 shows by way of timing charts a mode of operation of the water supplying apparatus for an automatic ice machine constructed according to the first embodiment of the present invention.

Fig. 5 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a third embodiment of the present invention.

Fig. 6 is a fragmentary sectional view of the water supplying apparatus for an automatic ice machine constructed according to the third embodiment of the present invention, particularly showing a modified state of the water supplying apparatus.

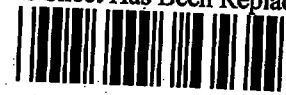


Fig. 7 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a fourth embodiment of the present invention.

Fig. 8 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a fifth embodiment of the present invention.

Fig. 9 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a sixth embodiment of the present invention.

Fig. 10 is a fragmentary sectional view of the water supplying apparatus for an automatic ice machine constructed according to the sixth embodiment of the present invention, particularly showing a modified state of the water supplying apparatus.

Fig. 11 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a seventh embodiment of the present invention.

Fig. 12 is a whole sectional view of a water supplying apparatus for an automatic ice machine constructed according to an eighth embodiment of the present invention.

Fig. 13 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a ninth embodiment of the present invention.

Fig. 14 is a schematic view of a controlling section for the water supplying apparatus for an automatic ice machine constructed according to the ninth embodiment of the present invention.

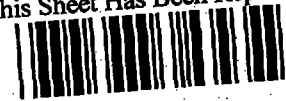


Fig. 15 shows by way of timing charts a mode of operation of the water supplying apparatus for an automatic ice machine constructed according to the ninth embodiment of the present invention.

Fig. 16 shows by way of sectional views the whole structure as well as the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a tenth embodiment of the present invention.

Fig. 17 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to an eleventh embodiment of the present invention.

Fig. 18 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a twelfth embodiment of the present invention.

Fig. 19 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a thirteenth embodiment of the present invention.

Fig. 20 is a sectional view of a conventional ice machine.

Fig. 21 is a sectional view of another conventional ice machine.



A first embodiment of the present invention will be described below with reference to Fig. 1 and Fig. 2. In Fig. 1, reference numeral 51 designates a refrigerating compartment, and reference numeral 52 designates an ice making compartment. A door switch 62 is disposed on a partition plate 62 interposed between the refrigerating compartment 61 and the ice making compartment. In addition, a water supply tank corner 54 is disposed at the lower stage of the refrigerating compartment 51, and an ice machine 55 is disposed in the ice making compartment 52.

[0038]

Referring to Fig. 2, a water supply path 63 including a water tank assembly 58 having a measuring unit 60 incorporated therein, a solenoid 57 and a conical member 61 is arranged in the water supply corner 54. The solenoid 57 serves as driving means and it is located outside of the water supply path 63 in such a manner that its actuating shaft extends through the wall for the water supply path 63 to enter the interior of the water supply path 63 while it is displaceable in the upward/ downward direction. The conical member 61 is attached to the foremost end of the actuating shaft of the solenoid 57 to serve as sealing means, and it is molded of a silicone based material. Further, the conical member 61 is located in vertical alignment with the lower end of a cooperating shaft 69 in the coaxial relationship. An ice making tray 66 is disposed below the water supply path 63 in the ice making compartment 52. The



water tank assembly 68 is composed of a water tank 59 and a cap 70 having the measuring unit 60 incorporated therein. The measuring unit 60 includes an inner case 71 having an outflow hole 67, an inflow hole 65 and an air venting hole 74 formed thereon, an upper case 72 including an active carbon 73 and an inflow valve 66 disposed in the inner case 71 on the inflow hole 65 side so as to allow the inflow hole 65 to be closed with the inflow valve 66. An outflow valve 68 adapted to close the outflow hole 67 therewith, a cooperating shaft 69 for integrating both the valves 66 and 68 with each other and a spring 75 located on an extension of the cooperating shaft 69 on the outflow valve 67 side are arranged on the outflow hole 67 side. While any force is not exerted on the cooperating shaft 69 from below, both the inflow valve 66 and the outflow valve 68 are lowered by the resilient force of the spring 75 so that the inflow hole 65 is kept opened but the outflow hole 67 is closed with the outflow valve 68. When the solenoid 57 disposed outside of the water supply path 63 is activated, the conical member 61 is displaced in the upward direction so that the cooperating shaft 69 is upwardly thrust from below. While the force given by the conical member 61 is exerted on the cooperating shaft 69 from below, the spring 75 is contracted and both the inflow valve 66 and the outflow valve 68 are raised up, whereby the inflow hole 65 is closed with the inflow valve 66 but the outflow hole 67 is kept opened. The upper



case 72 is fixedly secured to the inner case 71 by tightening screws or by fitting the former into the latter.

[0039]

Next, a mode of operation of the water supplying apparatus constructed in the aforementioned manner will be described below with reference to Fig. 1 and Fig. 2. While the solenoid 57 is not activated, the conical member 61 is lowered. At this time, the spring 75 is caused to expand so as to allow the cooperation shaft 69 to be lowered. Since the inflow hole 65 is kept opened at this time, the water stored in the water tank 59 permeates through the active carbon 73 to enter the upper case 72, and subsequently, it enters the measuring chamber 64 through the inflow hole 65. However, since the outflow hole 67 is closed with the outflow valve 68, the measuring chamber 64 is fully filled with water. At this time, the air vent 74 permits water to smoothly flow therethrough via the inflow hole 65. Subsequently, when the solenoid 57 is activated, the conical member 61 is upwardly displaced to come in contact with the cooperating shaft 69 which in turn is raised up until the inflow hole 65 is closed with the inflow valve 66. Since the outflow hole 67 is opened at this time, the water stored in the measuring chamber 64 is discharged through the outflow hole 67 without any additional supplement of water from the water tank 59. Thus, since only the water stored in the measuring chamber 64 is caused to flow to the ice making tray 56 via the water supply path 63, water supplying can be achieved at a constant



rate but it can not be achieved within a constant period of time because no air venting hole is formed in connection with the outflow hole 67. In other words, although the outflow time fluctuates when the solenoid 57 is activated for a long time, water supplying can be achieved at a constant rate at all timed.

Since all water is supplied from the completely closed water tank 59 without any opportunity to be exposed to the environmental air, few bacillus floating in the air is adsorptively included in water, resulting in various kinds of bacilli failing to be grown in water. In addition, since the cap 70 is dimensioned to have a large diameter enough to allow an operator's hand to be put in the cap 70, the interior of the water tank 69 can easily be cleaned with his hand. Further, since the solenoid 57 having electrical connection to the outside is arranged independently of the water tank assembly 68, it is possible to freely take out the water tank assembly 68 from the water tank corner 54. Thus, cleaning and maintenance services can be performed easily.

Since the conical member 61 is molded of a silicone based material, there is no possibility that water is introduced into the solenoid 57, and moreover, no noisy sound is generated when the conical member 61 is brought in contact with the outflow valve 68 via the cooperating shaft 69.

[0040]

Embodiment 2



Although the first embodiment of the present invention has been described above with respect to the case that the solenoid 57 is independently activated, Fig. 3 and Fig. 4 show a second embodiment wherein the solenoid 57 is activated in operative association with a door switch 62. Fig. 3 is a schematic illustrative view which shows the arrangement of the door switch 57 and Fig. 4 is a diagram which shows timing charts. Referring to Fig. 3, a refrigerator includes a control base board 76 to which the solenoid 57 and the door switch 61 are electrically connected. On the other hand, the control base board 76 is electrically connected to a power source 77 for the purpose of power supply. As shown in Fig. 4, the timing relationship is determined such that when a water supply start signal is outputted from the control base board 76, the solenoid 67 is turned on for a predetermined time, and subsequently, it is turned off when the door switch 62 is opened.

[0041]

It is assumed that while the solenoid 57 is activated, a door (not shown) is opened so as to take out a water tank assembly 58 from the water supply tank corner 54. Provided that the solenoid 57 is turned on and a conical member 61 is raised up at this time, there is a possibility that a cap 70 or the conical member 61 is damaged or an actuation shaft of the solenoid 57 deflects due to the contact of the conical member 61 with the cap 70. However, since the door switch 62 is



actuated in operative association with the solenoid 57 via the door, when the door is opened, the conical member 61 is lowered, causing the outflow hole 67 to be closed with the outflow valve 68. Thus, the water tank assembly 58 can be taken out from the water supply tank corner 54 without an occurrence of damage or injury thereof.

[0042]

Embodiment 3

In the aforementioned embodiments, the ice making compartment 52 is communicated directly with the refrigerating compartment 51 without any sealing means interposed therebetween. For this reason, there is a possibility that cold air leaks from the water supplying apparatus, resulting in a frost arising at some part of the water supply apparatus. To cope with the foregoing malfunction, a measure is taken according to a third embodiment of the present invention as illustrated in Fig. 5. Specifically, as shown in Fig. 5, the intermediate part of a water supply path 63 is exploded so that a float case 81 is placed at the exploded part of the water supply path 63 with a float 80 disposed at an outlet port of the float case 81.

[0043]

With this construction, the ice making compartment 52 is separated from the refrigerating compartment 51 with the float 80 interposed therebetween. As water flows in the float case 81, the float 80 is raised up by the action of buoyancy. Thus,



after a small amount of water is stored in the float case 31, it is caused to flow through the water supply path 63. In other words, water flow is assured while preventing any cold air from leaking from the water supplying apparatus.

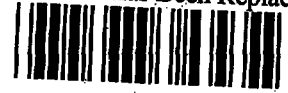
[0044]

In the preceding embodiment, the float 80 is disposed at the intermediate part of the water supply path 63. Alternatively, as shown in Fig. 6, the float 80 may be connected to the conical member 61 via a connecting rod 82 so as to exhibit the same function as that in the preceding embodiment. Specifically, when the solenoid 57 is turned off, the conical member 61 is lowered, causing the connecting rod 82 to be likewise lowered until the water supply path 63 is closed with the float 80. Thus, communication between the ice making compartment 52 and the refrigerating compartment 51 is interrupted by the float 80 to prevent cold air from leaking from the water supplying apparatus. While the solenoid 57 is turned on, i.e., water flows through the outflow hole 67, the conical member 61 is raised up, causing the connecting rod 82 to be likewise raised up, resulting in the water flowing through the water supply path 63.

[0046]

Embodiment 4

In the aforementioned embodiments, since the solenoid 57 is activated so as to allow the conical member 61 to be displaced in the upward/downward direction, there is a possibility that



a part of water leaks in the form of water drops from the location where the conical member 61 is connected to the solenoid 57 via the actuation shaft, resulting in reliability on the activation of the solenoid 57 being degraded. To cope with the foregoing malfunction, a measure is taken according to a fourth embodiment of the present invention as illustrated in Fig. 7. Referring to Fig. 7, a spring 84 is interposed between the conical member 61 and the water supply path 63, and the lower end of the conical member 61 comes in contact with one end of a L-shaped arm 83 of which other end is pivotally connected to the solenoid 57 which is arranged with a horizontal attitude.

[0046]

While the solenoid 57 is turned off, the conical member 61 is lowered by the resilient force of the spring 84. Subsequently, when the solenoid 57 is turned on, the arm 83 turns about a fulcrum in the clockwise direction to raise up the conical member 61 while compressing the spring 84. Consequently, also in this embodiment, the solenoid 57 serves in the same manner as in the aforementioned embodiments wherein it is activated in the upward/downward direction.

[0047]

Embodiment 5.

Referring to Fig. 8, a flexible conical member 90 molded of a rubber is operatively connected to the solenoid 57 so as to be raised up and lowered in operative association with the



solenoid 57, and a shaft of the solenoid 56 extends through a hole which is formed through an open type water supply path 63.

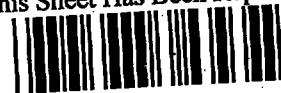
[0048]

Since the flexible conical member 90 is molded of a rubber, not only when the solenoid 57 is activated so as to allow the conical member 90 to be raised up to the position as represented by reference character B but also when it is activated so as to allow the conical member 90 to be lowered to the position as represented by reference character A, there does not arise a malfunction that the conical member 90 is disconnected from the periphery of the hole formed at the intermediate position of the water supply path 63. In other words, there is no possibility that water enters the solenoid 57 irrespective of how the solenoid 57 is activated.

[0049]

Embodiment 6

In the fifth embodiment as mentioned above, since the ice making compartment 52 is communicated directly with the refrigerating compartment 51 without any sealing means interposed therebetween, there is a possibility that cold air leaks from the water supplying apparatus, causing a frost to appear at some part of the water supplying apparatus. To cope with the foregoing malfunction, a measure is taken according to a sixth embodiment of the present invention as illustrated in Fig. 9. Specifically, as shown in Fig. 9, a trap 92 (serving



as a water reservoir) is disposed at the intermediate position of the water supply path 63.

[0050]

With this construction, as the trap 92 is filled with water, an extra amount of water flows out of the trap 92 through the water supply path 63 while preventing cold air from leaking from the ice making compartment 52 and the refrigerating compartment 51.

[0051]

In this embodiment, the trap 92 is arranged such that it is integrated with a part of the water supply path 63. In case that the foregoing arrangement is practically impossible, it is recommendable that a trap cover 93 is placed at the intermediate part of the water supply path 63 and a trap 92 is formed in cooperation with the trap cover 93 as shown in Fig. 10(a). Fig. 10(b) is a perspective view of the trap 92, particularly showing the structure of the trap cover 93. As water flows in the trap 92 via the trap cover 93 until the trap 92 is filled with water, an extra amount of water flows out of the trap 92 while preventing cold air from leaking from the water supplying apparatus. Fig. 10(c) is a fragmentary sectional view of the water supply path 63, particularly showing that the trap cover 93 is firmly held on the water supply path 63 by fitting an annular projection on the trap cover 93 into the corresponding recess on the water supply path 63.



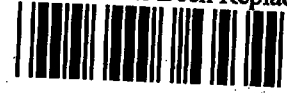
[0052]

Embodiment 7

In the aforementioned embodiments, the water supply path 63 is utilized as sealing means for sealably isolating the ice making compartment 52 from the refrigerating compartment 51. In contrast with them, this embodiment is intended to utilize the fitting region where the cap 70 is fitted into the water supply path 63 as illustrated in Fig. 11. Specifically, referring to Fig. 11, an annular cap sealing rib 95 extending downward of the cap 70 is fitted into a water supply path sealing rib 94 extending upward of the water supply path 63 when the cap 70 and the water supply path 63 are assembled with each other by fitting the former into the latter.

[0053]

With this construction, since the water supply path sealing rib 94 is loaded with the dead weight of the whole water tank assembly 58 inclusive of the cap 70, there does not arise a malfunction that cold air leaks from the water supplying apparatus. In other words, water flows through the water supply path 63 without an occurrence of leakage of the cold air. When the cap 70 is dimensioned to have a thickness t_2 much larger than a thickness t_1 of the water tank 59, it is assured that the cap 70 can be kept flat no matter how the water tank 59 is distorted. In addition, since the water tank assembly 58 is heavy, there does not arise a malfunction that an annular gap appears between the water supply path sealing



rib 94 and the cap sealing rib 95 due to the heavy dead weight of the water tank assembly 58 itself irrespective of whether the tank 59 is filled with water or not. As shown in Fig. 11(b), it is recommendable that an annular packing 102 is fitted onto the water supply path sealing rib 94 in order to exhibit an additional sealing effect with the packing 102. Obviously, an annular packing (not shown) similar to the packing 102 may be fitted onto the cap sealing rib 95 for the same purpose.

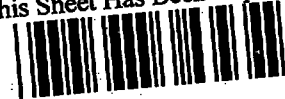
[0054]

Embodiment 8

In the aforementioned embodiments as shown in Fig. 8 to Fig. 10, one end of the flexible conical member 90 molded of a rubber is fitted to a part of the open type water supply path 63. Fig. 12 illustrates an embodiment wherein the conical member 90 is fitted to another member. Specifically, as shown in the drawing, a cleaning tray 91 having the substantially same configuration as that of the open type water supply path 63 is placed on the water supply path 63, and one end of the flexible conical member 90 is fitted to the cleaning tray 91.

[0055]

With this construction, since the flexible conical member 90 is fitted to the cleaning tray 91 but not to the water supply path 63, as water flows out of the water tank assembly 58, it passes by the conical member 90 and flows along the cleaning tray 91 to reach the ice making compartment 52 without



any entrance of the water in the solenoid 57 and the open type water supply path 63. Thus, this embodiment is preferably employable not only from the viewpoint of quality of a product of ice but also from the viewpoint of a sanitary engineering.

[0056]

Embodiment 9

In the aforementioned embodiments, it is not detected whether water is present in the water tank assembly 58 or not. Fig. 13 illustrates an embodiment wherein water absence detecting means is arranged in the water tank assembly 58. As shown in the drawing, a water absence detecting case 96 is firmly placed on the cap 70, and a plurality of inflow/outflow holes 100 are formed through the water absence detecting case 96 at the upper part as well as the lower part of the latter. A water absence detecting ball 97 having a magnet incorporated therein is received in the water absence detecting case 96 such that it can be displaced in the upward/downward direction as seen in the drawing. A lead switch 99 is attached to the water supply path 63 at the lower position located opposite to the magnet 98.

[0057]

With this construction, when water is temporarily absent in the cap 70, the water absence detecting ball 97 is lowered in excess of a predetermined lower position, causing the lead switch 99 to be turned on. On receipt of a signal from the lead switch 99, the cap 70 is immediately supplied with water



so that the lead switch 99 is turned off because the water absence detecting ball 97 is raised up by the action of buoyancy. However, when water completely disappears from the interior of the cap 70 for some reason, the lead switch 99 is turned off for a longer time. In these circumstances, a controller (not shown) in the control base board 76 determines that no water is present in the water tank assembly 58 when the lead switch 99 is turned off for a time longer than a predetermined time (t).

[0058]

Fig. 14 is a schematic illustrative view which shows a wiring system for the water supplying apparatus, and Fig. 15 is a diagram which shows several timing charts. Referring to Fig. 14, the lead switch 99 and a light emitting diode 101 adapted to be illuminated for indicating a command of water supply are electrically connected to the control base board 76, and when the controller determines that no water is present in the water tank assembly 58, the light emitting diode 101 is illuminated (the position where the water supplying apparatus is disposed is not shown in the drawing).

[0059]

Embodiment 10

Next, a tenth embodiment of the present invention will be described below with reference to Fig. 16. As shown in the drawing, a water tank assembly 58 inclusive of a measuring unit 60 and a water supply path 63 inclusive of a solenoid 57 and a



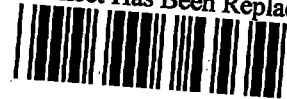
conical member 61 are arranged in the water supply tank corner 54, and the solenoid 57 is disposed outside of the water supply path 63. An actuating shaft 161 of the solenoid 57 extends through a wall of the water supply path 63 until it is exposed to the interior of the water supply path 63. The conical member 61 is attached to the foremost end of the actuating shaft 161. An ice making tray 56 is disposed in the ice making compartment 52 at the position located below the water supply path 63. The water tank assembly 58 and the measuring unit 60 are placed on a cap 70 having an outflow hole 67 formed thereon. In addition, the water supplying apparatus includes an inner case 71 having an inflow hole 65 formed thereon and including a measuring chamber 64 and a cylindrical air vent 74, an inflow valve seat 177 molded of an elastic material such as a rubber or the like and adapted to be fitted into the inflow hole 65, an upper case 72 including a water cleaning filter 73 and having an air vent hole 170 formed on a ceiling plate thereof, and a cooperating shaft 69 slidably displaceable in the upward/downward direction. A circular disc 173 is made integral with the cooperating shaft 69 at the intermediate position of the latter, an outflow valve 174 adapted to close an outflow hole 67 therewith is disposed below the circular disc 173, and moreover, a spring 75 is disposed below the outflow valve 174 in such a manner that the cooperating shaft 69 is located in vertical alignment with the actuating shaft 161 of the solenoid 57 along a common axis. While no force is



exerted on the cooperating shaft 69 from below, the circular disc 173 is lowered by the resilient force of the spring 75 so that the inflow hole 65 is opened but the outflow hole 67 is closed with the outflow valve 174. When the solenoid 57 disposed outside of the water supply path 63 is activated, the conical member 61 is displaced in the upward direction and the cooperating shaft 69 is then raised up by the conical member 61 from below. While the cooperating shaft 69 is raised up by the force given the conical valve 61 from below, the spring 75 is contracted and the circular disc 173 is raised up to come in close contact with the inflow valve seat 177 so as to close the inflow hole 65 with the inflow valve seat 177 while the outflow hole 67 is kept opened. The upper case 72 is fixedly secured to the intermediate case 71 by tightening screws or by fitting the former onto the latter, and the intermediate case 71 is fixedly secured to the cap 70 by tightening screws.

[0060]

Next, a mode of operation of the water supplying apparatus constructed in the aforementioned manner will be described below. While the solenoid 57 is not activated, the conical member 61 is lowered, the spring 75 is caused to fully expand, and the cooperating shaft is also lowered. Since the inflow hole 65 is kept opened at this time, water flows in the upper case 72 through the water cleaning filter 73, and subsequently, it flows in the measuring chamber 64 through the inflow hole 65 until the measuring chamber 64 is filled with water, because



the outflow hole 67 is closed with the outflow valve 174. At this time, the air vent 74 assures that water is smoothly introduced into the measuring chamber 64 through the inflow hole 65. Next, when the solenoid 57 is activated, the conical member 61 is raised up and the cooperating shaft 69 is also raised up in operative association with the conical member 61. Thus, the circular disc 173 is brought in close contact with the inflow valve seat 177 to close the inflow hole 65 with the circular disc 173, and the outflow hole 67 is opened. This causes the water stored in the measuring chamber 64 to be discharged through the outflow hole 67 but no water is supplied from the water tank 69 at this time. For this reason, a predetermined quantity of water stored only in the measuring chamber 64 is delivered to the ice making tray 56 via the water supply path 63. In other words, constant water supplying is achieved at a predetermined rate. Since the inflow valve seat 177 is molded of an elastic material, when the circular disc 173 is brought in close contact with the inflow valve seat 177 in the course of a working stroke of the actuating shaft 161 of the solenoid 57, the inflow valve seat 177 is elastically deformed, enabling the actuating shaft 161 of the solenoid 57 to be raised up by a distance corresponding to a specified working stroke thereof not only without any generation of vibration and unpleasant groaning sound but also without an occurrence of leakage of water from the measuring chamber 64. Since water is supplied only from the completely closed water



tank assembly 58 without any exposure to the environmental air during water supplying, few bacillus floating in the air is adsorptively included in the supplied water. As a result, few growth of bacillus is recognized with the supplied water, whereby soaking of a foodstuff with certain odor via the supplied water to be frozen can be prevented.

An air vent hole 170 formed through the upper case 72 is intended to vent the air in the upper case 72 therethrough. Since a certain quantity of air remains in the upper case 72 and the measuring chamber 64 after the cap 70 is fitted to the water tank assembly 58 which in turn is filled with water, the remaining air is vented to the water tank 59 through the air vent hole 170 in order to assure that the water stored in the water tank 59 is smoothly introduced into the upper case 72 through the water cleaning filter 73.

[0061]

Embodiment 11

In the preceding embodiment, the inflow valve seat 177 is disposed on the inflow hole 65 side of the inner case 71. Fig. 17 illustrates an embodiment wherein the inflow valve seat 177 is integrated with the outflow valve 174.

In the drawing, reference numeral 178 designates an inflow/outflow valve which is molded of an elastic material such as a rubber or the like. The inflow/outflow valve 178 is fitted onto a cooperating shaft 69. As the cooperating shaft 69 is slidably displaced in the upward/downward direction, the



inflow hole 65 is closed but the outflow valve 67 is opened and vice versa. With this construction, the same functional effect as that in the tenth embodiment is obtainable with the water supplying apparatus. Thus, the water supplying apparatus can be fabricated with a reduced number of components at an inexpensive cost without any possibility that water leaks from the inflow valve seat 177 due to incorrect fitting of the latter which may occur in the fifth embodiment.

[0062]

Embodiment 12

In each of the tenth and eleventh embodiments, since the ceiling plate of the inner case 71 is designed to be flat, some amount of air is liable to remain in the form of air bubbles in the space below the ceiling plate of the inner case 71, causing a quantity of water stored in the measuring chamber 64 to readily fluctuate. To cope with the foregoing malfunction, a measure is taken according to a twelfth embodiment of the present invention as illustrated in Fig. 18. As shown in the drawing, in this embodiment, an inclined ceiling plate 179 of which height increases toward the air vent 74 is substituted for the flat ceiling plate in each of the preceding embodiments. With this construction, all the air bubbles remaining below the inclined ceiling plate 179 are collected in the air vent 74 and then discharged to the water tank 69 through the air vent 74. Thus, the measuring chamber 64 is



fully filled with water without any remaining air, resulting in water supplying being achieved at a constant rate at all times.

[0063]

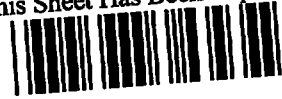
Embodiment 13

In each of the tenth, eleventh and twelfth embodiments, the air vent hole 170 is formed through the ceiling plate of the upper case 72 so as to allow the air remaining in the upper case 72 to be vented therethrough. With this construction, since all the water stored in the water tank 59 does not permeate through the water cleaning filter 73 but a part of the water enters the upper case 72 through the air vent hole 170 to reach the measuring chamber 64, there arises a malfunction that the water cleaning filter 73 can not fully exhibit its own functional effect. To cope with the foregoing malfunction, a measure is taken according to a thirteen embodiment of the present invention as illustrated in Fig. 13.

In the drawing, reference numeral 170 designates a cylindrical air vent which stands upright from the ceiling plate of the upper case 72. Since the air bent 170 is dimensioned to have a height higher than the surface level of water in the water tank 59, all the water in the water tank 59 is caused to permeate through the water cleaning filter 73. This makes it possible for the water cleaning filter 73 to fully exhibit its water filtering capability.

[0064]

[ADVANTAGEOUS EFFECTS OF THE INVENTION]



The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 1 of the claim clause includes as essential components a water tank disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, and driving means disposed below the water tank for driving the valve unit in order to open the inflow valve and close the outflow valve when the water stored in a measuring chamber of the measuring unit is supplied onto the ice making tray in the ice making compartment, the driving means including sealing means adapted to come in contact with the valve assembly in the vicinity of the driving means so as to prevent the driving means from being wetted with water. therefrom. Specifically, when the water in the water tank is introduced into the measuring chamber, the outflow valve is closed while the inflow valve is opened, and when the water in the measuring chamber is discharged therefrom, the inflow valve is closed while the outflow valve is opened. Since the measuring chamber is received in the completely closed water tank, there does not arise a malfunction that various kinds of bacilli floating in



the air are adsorptively included in the water stored in the measuring chamber. With this construction, there is few possibility that the water tank and other components are coated with a film or layer of slime and a sanitary quality of water in the water tank is degraded. In addition, cleaning and maintenance services can easily be conducted for the water supplying apparatus.

[0065]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 2 of the claim clause includes as essential components a measuring unit disposed in an accommodating chamber different from the ice making compartment and located above the latter, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, a water tank, and driving means disposed below the water tank for driving the valve assembly in order to close the inflow valve and open the outflow valve when the water stored in a measuring chamber of the measuring unit is supplied onto the ice making tray in the ice making compartment, wherein a door switch mounted on a door of a refrigerator is opened or closed in operative association with the driving means such that the outflow valve is closed



when the door is opened. With this construction, safety of the water supplying apparatus can be improved. In addition, there does not arise a malfunction that the water tank is damaged or injured due to incorrect removal of the water tank from the water tank accommodating chamber.

[0066]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 3 of the claim clause includes as essential components a measuring unit disposed in an accommodating chamber different from the ice making compartment and located above the latter, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, a water tank, and driving means disposed for driving the valve assembly in order to supply the water in a measuring chamber of the measuring unit through the outflow hole by opening the latter, wherein a water supply path extending from the accommodating chamber to the ice making tray is designed in the form of an open type water supply path of which outlet port is opened or closed by a float valve. With this construction, water supplying can be achieved without an occurrence of leakage of cold air from the region between the ice making compartment and the refrigerating



compartment not only in case that the water supplying apparatus is positionally offset from the ice making tray as seen in the horizontal direction but also in case that it is practically difficult to extend a water supply pipe around the water supply apparatus and other components as desired.

[0067]

The water supplying apparatus for an automatic ice machine as defined by claim 4 is improvably modified from the water supplying apparatus as defined by claim 1 of the claim clause in such a manner that the driving means for driving the valve assembly is dislocated in the horizontal direction so that the outflow hole is opened or closed via a connecting mechanism with the aid of the driving means adapted to be activated in the upward/downward direction. With this construction, there is few possibility that water drops enter a solenoid constituting the driving means. Thus, reliability of the water supplying apparatus can be improved.

[0068]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 5 of the claims clause includes as essential components a water tank disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly comprising an inflow valve and an



outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, and driving means disposed below the water tank for driving in order to open the outflow valve and close the inflow valve when the water stored in a measuring chamber of the measuring unit is supplied onto the ice making tray in the ice making compartment through the outflow hole by opening the latter, wherein a flexible member molded of a rubber and adapted to be displaced in operative association with the driving means is fitted to a part of an open type water supply path extending from the accommodating chamber to the ice making compartment. With this construction, since the solenoid constituting the driving means is sealably isolated from the open type water supply path via the rubber of the flexible member. Thus, there is no possibility that water enters the solenoid for the driving means, resulting in the solenoid failing to be correctly activated.

[0069]

The water supplying apparatus for an automatic ice machine as defined by claim 6 is improvably modified from the water supplying apparatus as defined by claim 5 of the claim clause in such a manner that a water reservoir is disposed at the intermediate part of the water supplying path extending from the accommodating chamber to the ice making tray. This construction can prevent not only leakage of cold air from the



water supplying apparatus but also growth of a frost around the water supplying apparatus.

[0070]

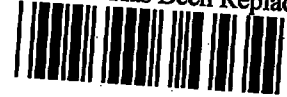
The water supplying apparatus for an automatic ice machine as defined by claim 7 is improvably modified from the water supplying apparatus as defined by claim 5 of the claim clause in such a manner that the measuring chamber or the water tank is sealably fitted to the open type water supply path. This construction can prevent not only leakage of cold air from the water supplying apparatus but also growth of a frost around the same because the open type water supply path is brought in sealable contact with the water tank via the measuring chamber.

[0071]

The water supplying apparatus for an automatic ice machine as defined by claim 8 is improvably modified from the water supplying apparatus as defined by claim 5 of the claim clause in such a manner that a cleaning tray having the substantially same configuration as that of the open type water supply path is placed on the latter in the sealable fitting relationship. The arrangement of the cleaning tray having the substantially same configuration as that of the water supply path assures that cleanability of the open type water supply path can be improved.

[0072]

The water supplying apparatus for an automatic ice machine as defined by claim 9 is improvably modified from the water



supplying apparatus as defined by claim 5 of the claim clause in such a manner that a magnetic member is displaceably received in the measuring chamber of the water tank. With this construction, while a lead switch is turned on for a time longer than a predetermined one, it can be detected that no water is present in the measuring chamber at present.

[0073]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 10 of the claim clause includes as essential components a water tank assembly disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly comprising an inflow valve and an outflow valve in such a manner as to close the outflow valve at the time of water inflow and close the inflow valve at the time of water outflow, driving means disposed below the water tank for driving the valve assembly in order to open the outflow and open the inflow valve when the water stored in the measuring chamber is supplied onto the ice making tray in the ice making compartment through the outflow hole by opening the latter, a cap having the outflow hole formed thereon, an inner case having the measuring chamber threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case



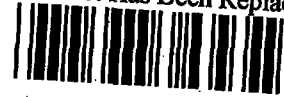
fitted to the inner case on the inflow hole side of the inner case and including the inflow valve molded of an elastic material such as a rubber or the like, an air venting hole formed at the upper part of the inner case and a water cleaning filter secured thereto, and a cooperating shaft held by the cap and the upper case to open and close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction, the cooperating shaft including the outflow valve molded of an elastic material such as a rubber or the like. This construction assures that various kinds of bacilli floating in the air are not adsorptively included in water while preventing not only deposition of a film or layer of slime on the water tank assembly and other components but also deterioration of a sanitary quality of water. In addition, the foregoing construction can prevent foodstuff and water from being soaked with unpleasant odor. Since the water supplying apparats is driven by activating the solenoid, no pumping sound is generated by the water supplying apparatus in contrast with the conventional water supplying apparatus. Further, since the inflow valve and the outflow valve are molded of an elastic material such as a rubber or the like, a magnitude of sound generated at the time of opening and closing of both the valves can be reduced while only low noisy sound is generated by them at that time. Another advantageous effects are that water leakage can reliably be prevented, and moreover,



water supplying can be achieved at a constant rate with the water supplying apparatus.

[0074]

The water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in the ice making compartment as defined by claim 11 of the claim clause includes as essential components a water tank assembly disposed in an accommodating chamber different from the ice making compartment and located above the latter with a measuring unit incorporated therein, the measuring unit including a valve assembly in the form of an inflow/ outflow valve in such a manner as to close an outflow valve at the time of water inflow and close an inflow valve at the time of water outflow, driving means disposed below the water tank for actuating the inflow/outflow valve in order to close the outflow hole and close the inflow valve when the water stored in the measuring chamber is supplied onto the ice making tray in the ice making compartment through the outflow hole by opening the latter, a cap having the outflow hole formed thereon, an inner case having the cap threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case disposed above the inner case, an air venting hole formed thereon and a water cleaning filter secured thereto, and a cooperating shaft held by the cap and the upper case so as to allow it to be slidably displaced in the upward/downward direction, wherein the



outflow/inflow valve firmly fitted onto the cooperating shaft is molded of an elastic material such as a rubber or the like in order to open or close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction. With this construction, in addition to the advantageous effects obtainable with the water supplying apparatus as defined by claim 10 of the claim clause, another advantageous effects are that the water supplying apparatus can be fabricated with a reduced number of components at an inexpensive cost, and moreover, water leakage attributable to incorrect mounting of the inflow/outflow valve can be prevented.

[0075]

The water supplying apparatus for an automatic ice machine as defined by claim 12 is improvably modified from the water supplying apparatus as defined by claim 10 or claim 11 of the claim clause in such a manner that the ceiling plate of the inner case is inclined such that its height gradually increases toward an air vent. This construction can prevent air from remaining below the ceiling plate when water is introduced into the measuring chamber through the inflow hole. Consequently, water supplying can be achieved at a constant rate with the water supplying apparatus.

[0076]

The water supplying apparatus for an automatic ice machine as defined by claim 13 is improvably modified from the water



supplying apparatus as defined by claim 10 or claim 11 of the claim clause in such a manner that an air venting hole is designed in the form of a cylindrical air vent standing upright from the inner case at a high height. With this construction, since when water in the water tank flows in the upper case, all the water is caused to permeate through the water cleaning filter, an excellent water cleaning effect can be obtained with the water supplying apparatus.

[EXPLANATION OF REFERENCE NUMERALS]

- 51 refrigerating compartment
- 52 ice making compartment
- 56 ice making tray
- 57 solenoid
- 59 tank
- 60 measuring mechanism
- 61 conical member
- 62 door switch
- 63 water supplying compartment
- 64 measuring chamber
- 65 inflow hole
- 66 inflow valve
- 67 outflow hole
- 68 outflow valve
- 69 cooperating shaft
- 74 air vent
- 80 float
- 82 connecting rod



- 90 conical member molded of a rubber
- 91 cleaning tray
- 92 trap
- 93 trap cover
- 94 water supply path sealing rib
- 95 cap sealing rib
- 96 water absence detecting case
- 97 water absence detecting ball
- 98 magnet
- 99 lead switch
- 161 actuating shaft
- 170 air venting hole
- 173 circular disc
- 174 outflow valve
- 177 inflow valve
- 178 outflow/inflow valve
- 179 inclined surface



CLAIMS

1. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said outflow valve at the time of water inflow and close said inflow valve at the time of water inflow, and driving means disposed below said water tank for driving said valve assembly in order to open said outflow valve and close said inflow valve when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment, wherein said driving means includes sealing means in the vicinity of said driving means so as to prevent said driving means from being wetted with the water stored in said water tank.

2. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water





onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a measuring unit disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said outflow valve at the time of water inflow and close said inflow valve at the time of water outflow, a water tank, and driving means disposed for driving said valve assembly to open said outflow valve and close said inflow valve when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment, wherein a door switch mounted on a door of a refrigerator is opened or closed in operative association with said driving means such that said outflow valve is closed when said door is opened.

3. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a measuring unit disposed in an accommodating chamber different from said ice making compartment and located above the latter, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said





outflow valve at the time of water inflow and close said inflow valve at the time of water outflow, a water tank, and driving means disposed for driving said valve assembly when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment through said outflow hole by opening the latter, wherein a water supply path extending from said accommodating chamber to said ice making compartment is designed in the form of an open type water supply path of which outlet port is opened or closed by a float valve.

4. A water supply apparatus for an automatic ice machine as claimed in claim 1, characterized in that said driving means for driving said valve assembly is dislocated in the horizontal direction so that said outflow valve is opened or closed in the upward/downward direction via a connecting mechanism.

5. A water supply apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said outflow valve at the





time of water inflow and close said inflow valve at the time of water outflow, and driving means disposed for opening said outflow valve and closing said inflow valve when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment through said outflow hole by opening the latter, wherein a flexible member molded of a rubber and adapted to be displaced in operative association with said driving means is fitted to a part of an open type water supply path extending from said accommodating chamber to said ice making compartment.

6. A water supplying apparatus for an automatic ice machine as claimed in claim 5, characterized in that a water reservoir is disposed at the intermediate part of said water supply path extending from said accommodating chamber to said ice making compartment so as to prevent cold air from leaking therefrom.

7. A water supplying apparatus for an automatic ice machine as claimed in claim 5, characterized in that said measuring chamber or said water tank and said open type water supply path are sealably arranged so as to prevent cold air from leaking therefrom.

8. A water supply apparatus for an automatic ice machine as claimed in claim 5, characterized in that a cleaning tray having the substantially same configuration as that of said open type water supply path is placed on said open type





water supply path so that it is fitted to one end of said flexible member molded of a rubber.

9. A water supplying apparatus for an automatic ice machine as claimed in claim 5, characterized in that a magnetic member is displaceably received in said measuring chamber.

10. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank assembly disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve in such a manner as to close an inflow hole and an outflow hole a measuring chamber incorporated therein so as to close said inflow valve at the time of water outflow and close said outflow valve at the time of water inflow, driving means disposed for opening said outflow valve and close said inflow valve when the water stored in a measuring chamber of said measuring unit onto said ice making tray in said ice making compartment through said outflow hole by opening the latter, a cap having said outflow hole formed thereon, an inner case having said measuring chamber threadably secured thereto, said inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case fitted to the inflow hole side of said inner case and





including said inflow valve molded of an elastic material such as a rubber or the like, an air venting hole formed at the upper part of said inner case and a water cleaning filter secured thereto, and a cooperating shaft held by said cap and said upper case to open and close said inflow hole and said outflow hole by slidable displacement thereof in the upward/downward direction, said cooperating shaft including said outflow valve molded of an elastic material such as a rubber or the like.

11. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank assembly disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit incorporated therein, said measuring unit including an outflow/inflow valve for closing an inflow hole and an outflow hole therewith in such a manner as to close an outflow valve of said inflow/outflow valve at the time of water inflow and close an inflow valve of the same at the time of water outflow, driving means disposed for opening said outflow valve and closing said inflow valve when the water stored in said measuring chamber is supplied onto said ice making tray in said ice making compartment through said outflow hole by opening the latter, a cap having said outflow hole formed thereon, an inner case having said cap threadably





secured thereto, said inflow hole formed thereon and a cylindrical air vent standing upright therefrom, and an upper case disposed above said inner case and having an air venting hole formed thereon and a water cleaning filter secured thereto, and a cooperating shaft held by said cap and said upper case so as to allow it to be slidably displaced in the upward/downward direction, wherein said inflow/outflow valve fitted onto said cooperating shaft is molded of an elastic material such as a rubber or the like in order to open or close said inflow hole and said outflow hole by slidable displacement thereof in the upward/downward direction.

12. A water supplying apparatus for an automatic ice machine as claimed in claim 10 or claim 11, characterized in that the ceiling plate of said inner case is inclined such that its height increases toward said air vent.

13. A water supplying apparatus for an automatic ice machine as claimed in claim 10 or claim 11, characterized in that said air vent hole is designed in the form of a cylindrical air vent standing upright from said upper case.

14. A water supplying apparatus substantially as herein described with reference to figures 1 to 4, 5 and 6, 7, 8, 9 and 10, 11, 12, 13 to 15, 16, 17, 18 or 19 of the accompanying drawings.





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ABSTRACT

WATER SUPPLYING APPARATUS FOR AN AUTOMATIC ICE MACHINE

A water supplying apparatus for an automatic ice machine disposed in an ice making compartment 52 supplies water to an ice making tray 56 in the ice making compartment 52. The water supply apparatus comprises a water tank 59 disposed in an accommodating chamber different from the ice making compartment 52 and located above the latter with a measuring unit 60 incorporated therein. The measuring unit 60 includes a valve assembly comprising an inflow valve 66 and an outflow valve 68 arranged to close an outflow hole 67 at a time when water flows in and close the inflow valve 66 at a time when water flows out; and driving means 57 disposed below the water tank 59 to drive the valve assembly in order to open the outflow valve 68 and close the inflow valve 66 when the water stored in a measuring chamber of the measuring mechanism is supplied to the ice making tray in the ice making compartment. The driving means may include sealing means 61 adapted to come in contact with the valve assembly so as to prevent the driving means from being wetted with water. The water supplying apparatus includes no water receiving section which allows exposure of the water to the environmental air, thereby preventing bacilli from entering the water.

Fig. 2B.

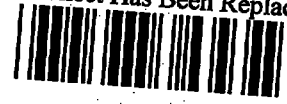
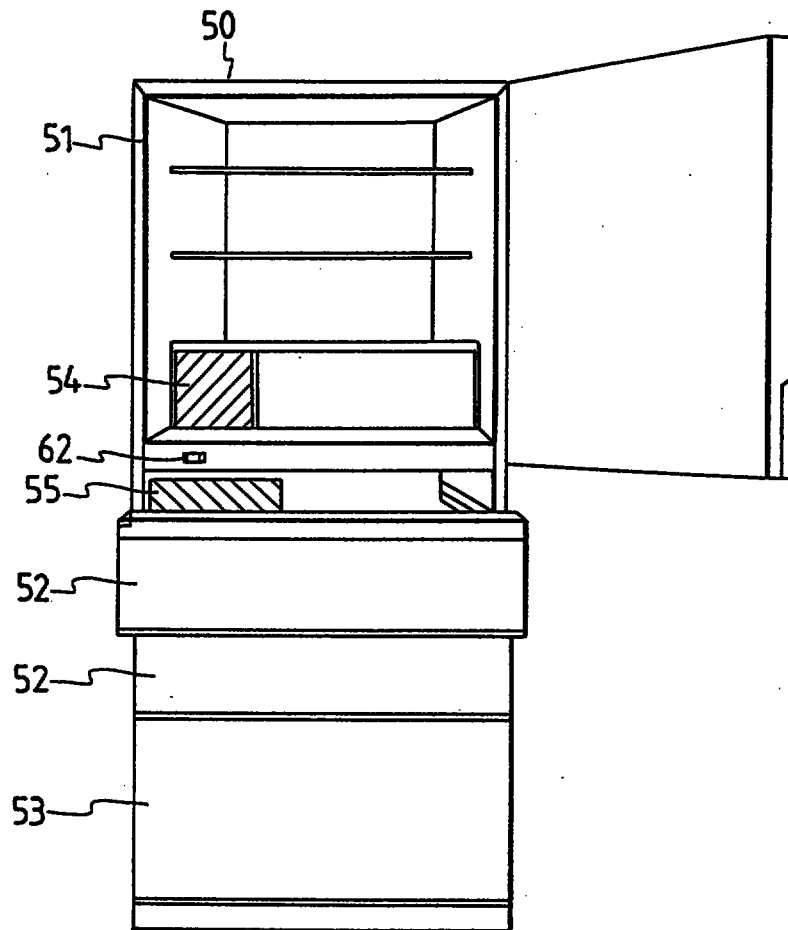


FIG. 1



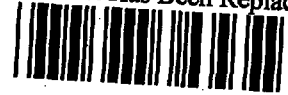


FIG. 2A

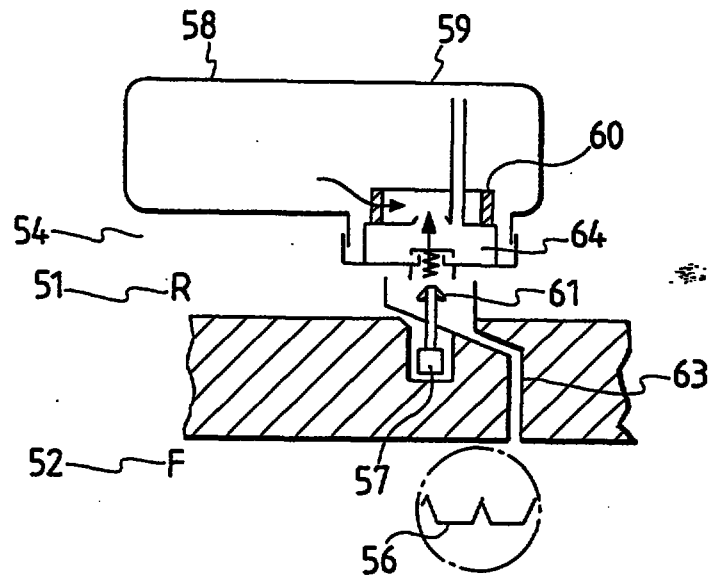


FIG. 2B

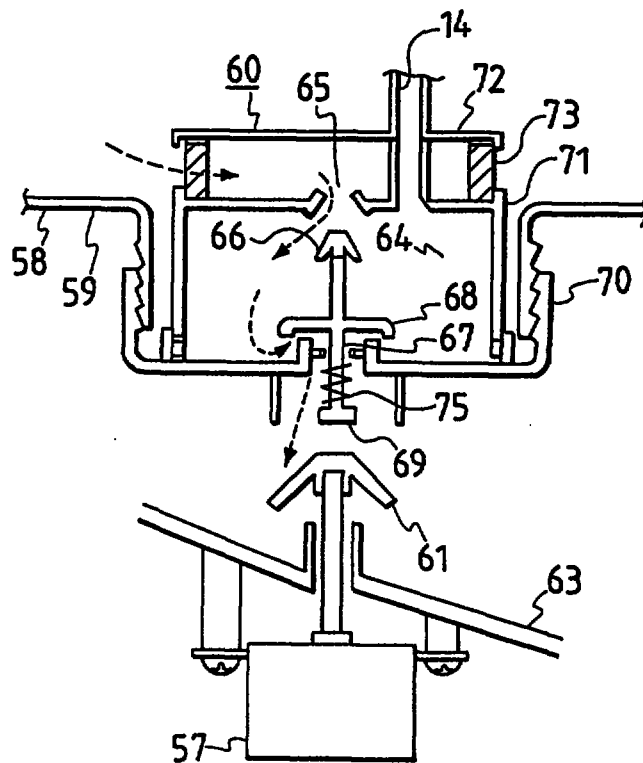




FIG. 3

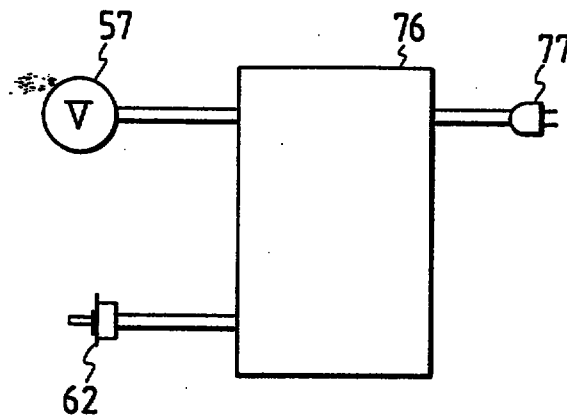


FIG. 4

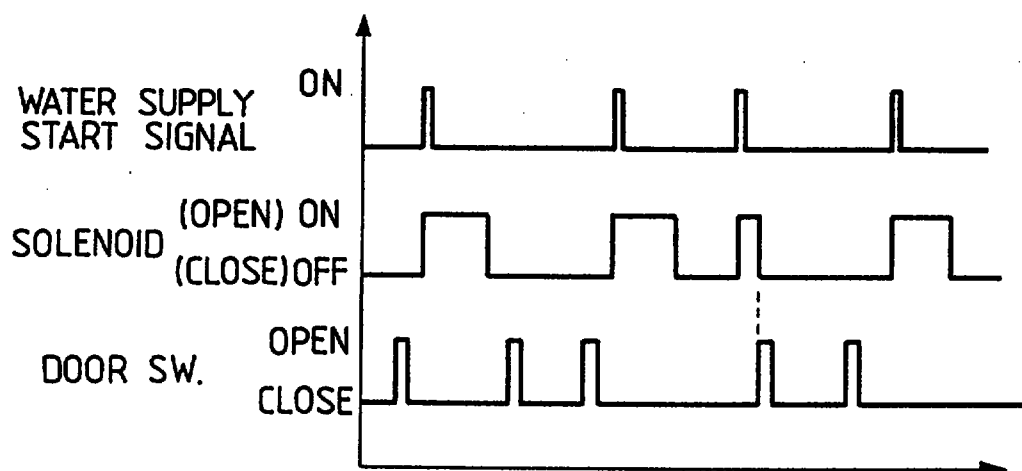




FIG. 5

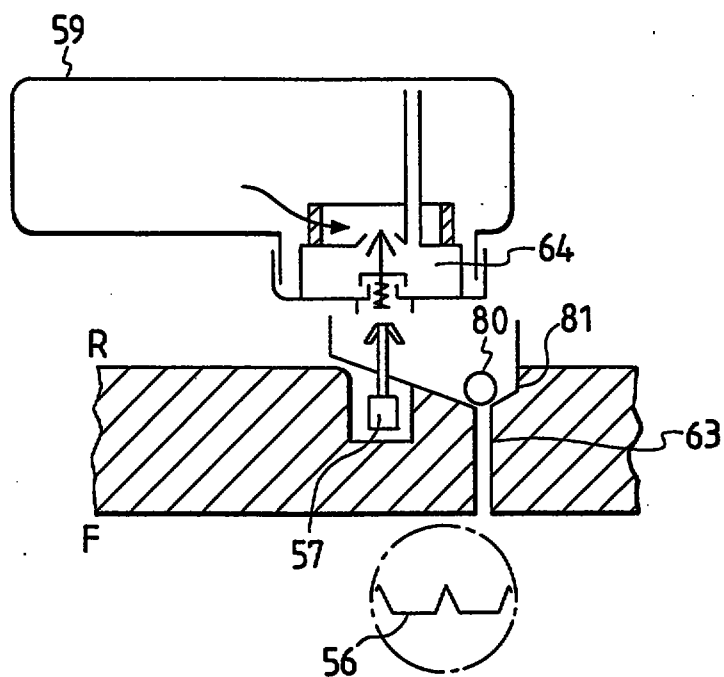
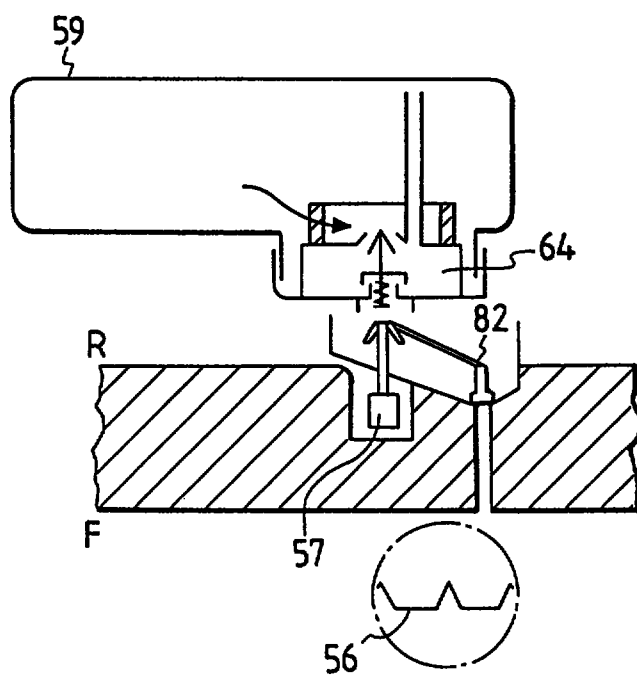


FIG. 6



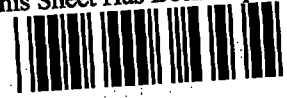


FIG. 7

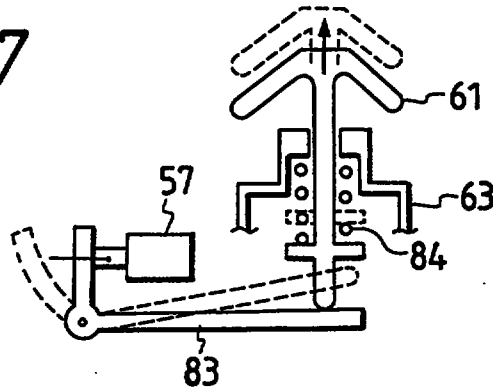


FIG. 8

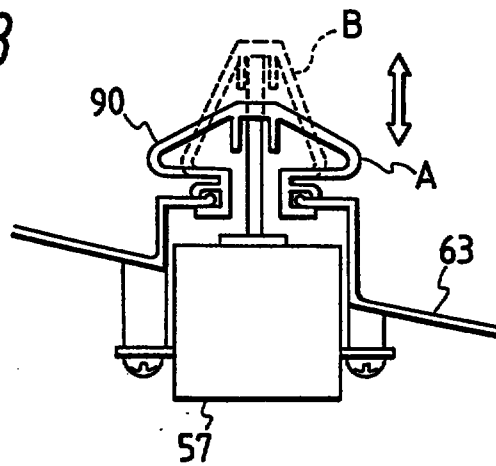


FIG. 9

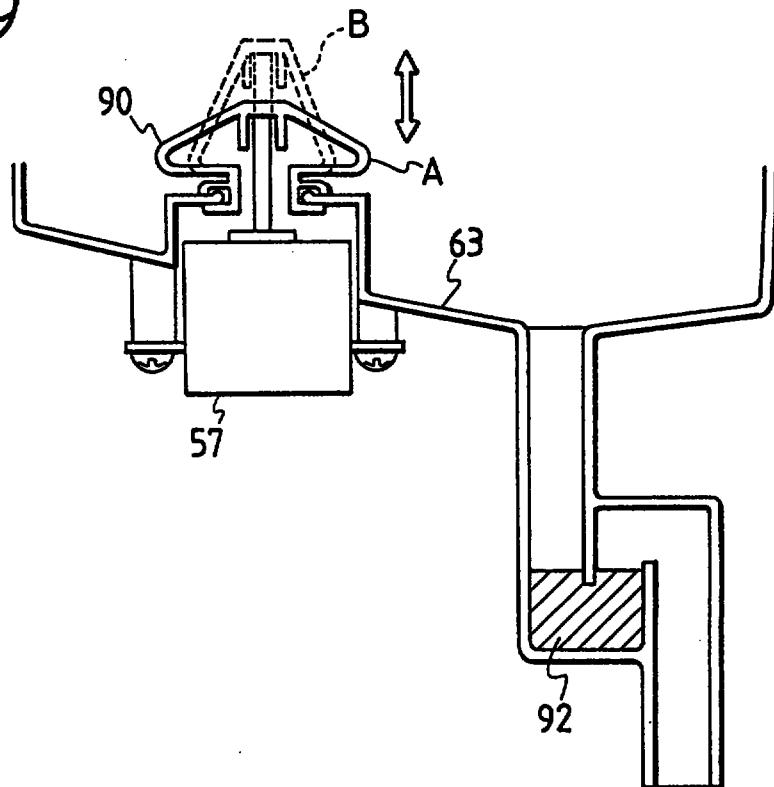




FIG. 10A

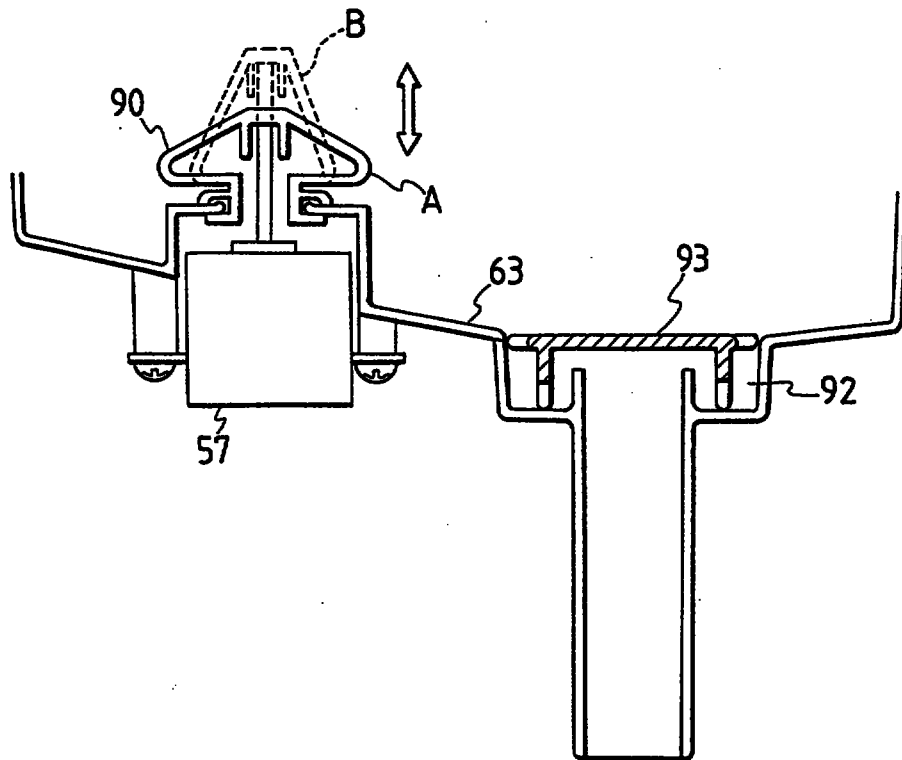


FIG. 10B

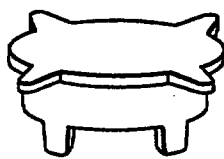


FIG. 10C

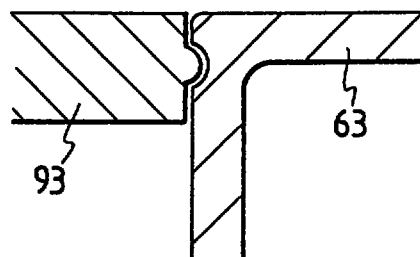


FIG. 11A

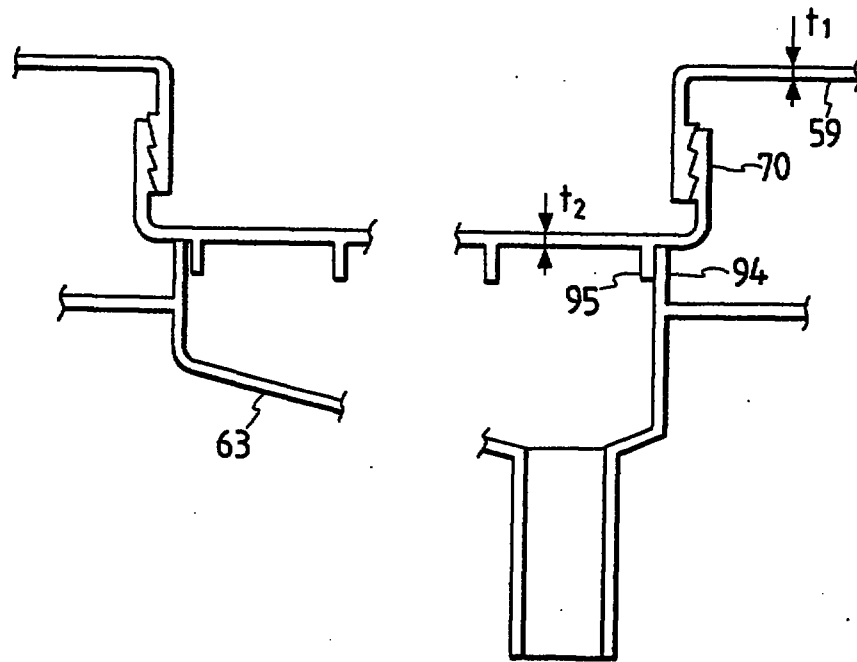


FIG. 11B

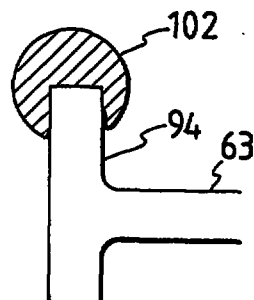




FIG. 12

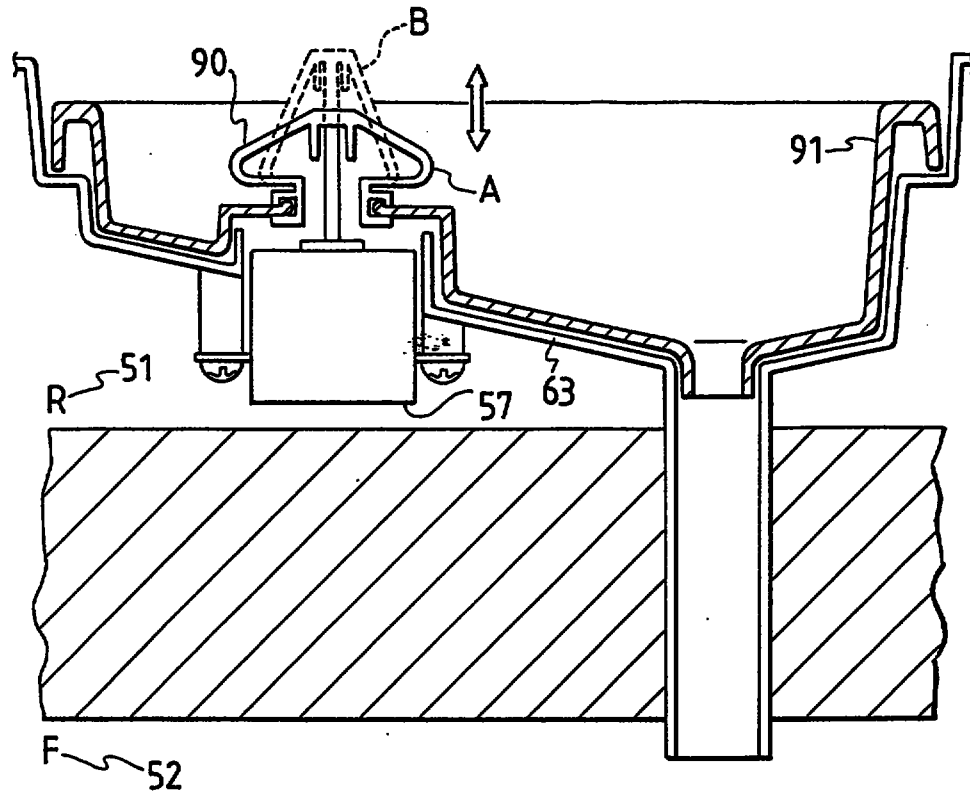


FIG. 13

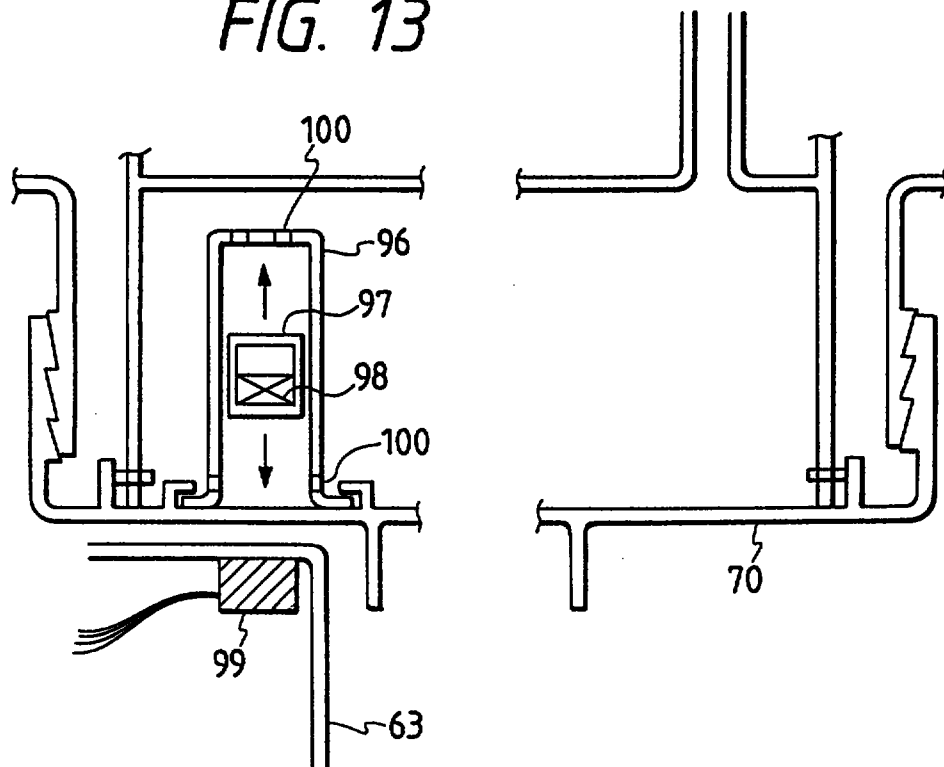




FIG. 14

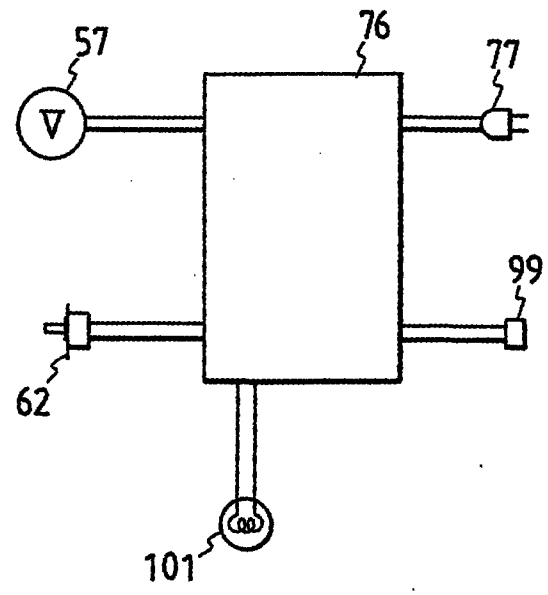


FIG. 15

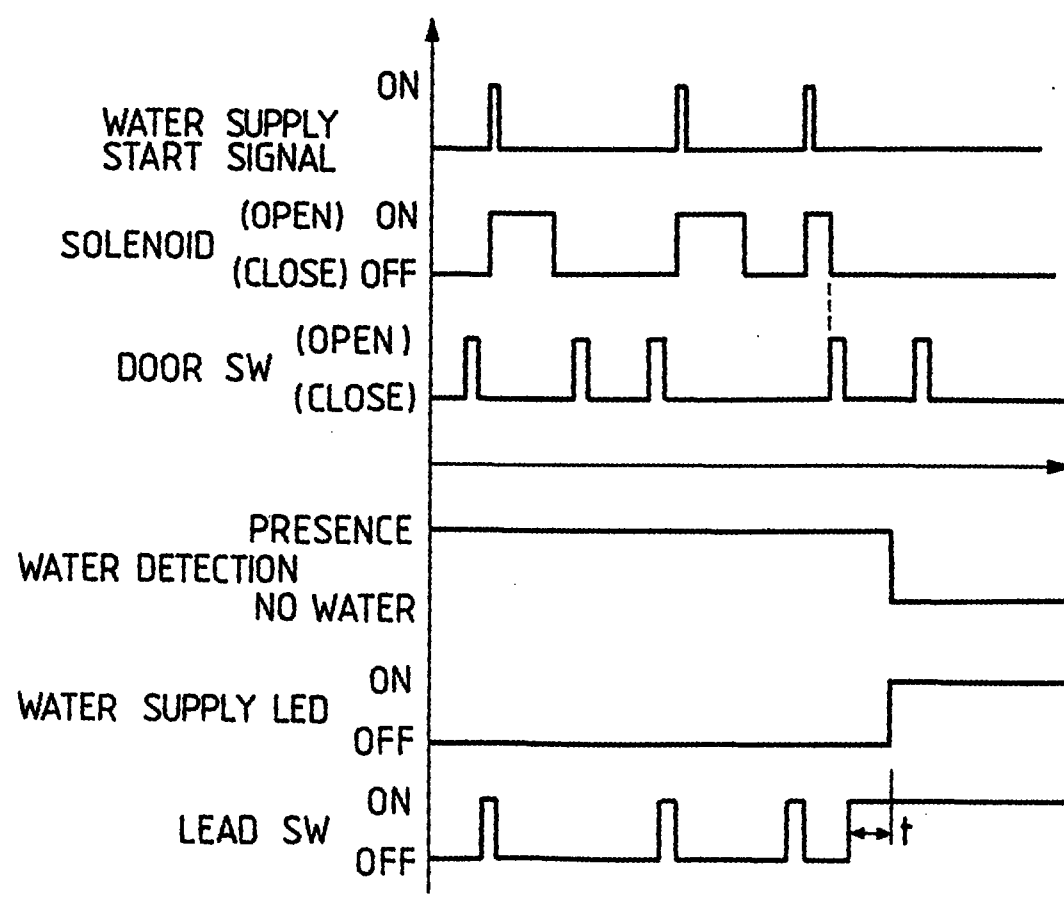




FIG. 16A

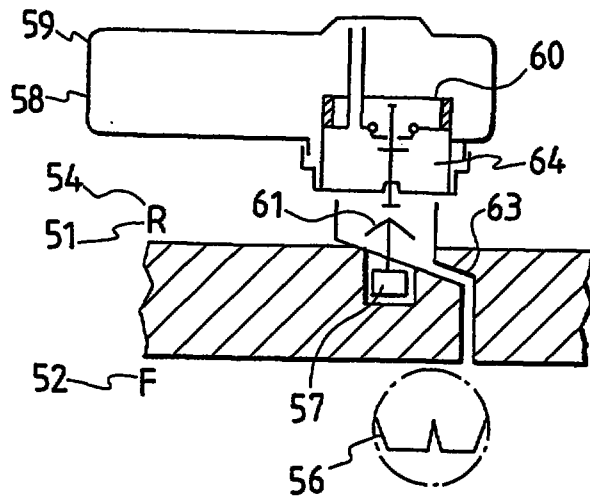


FIG. 16B

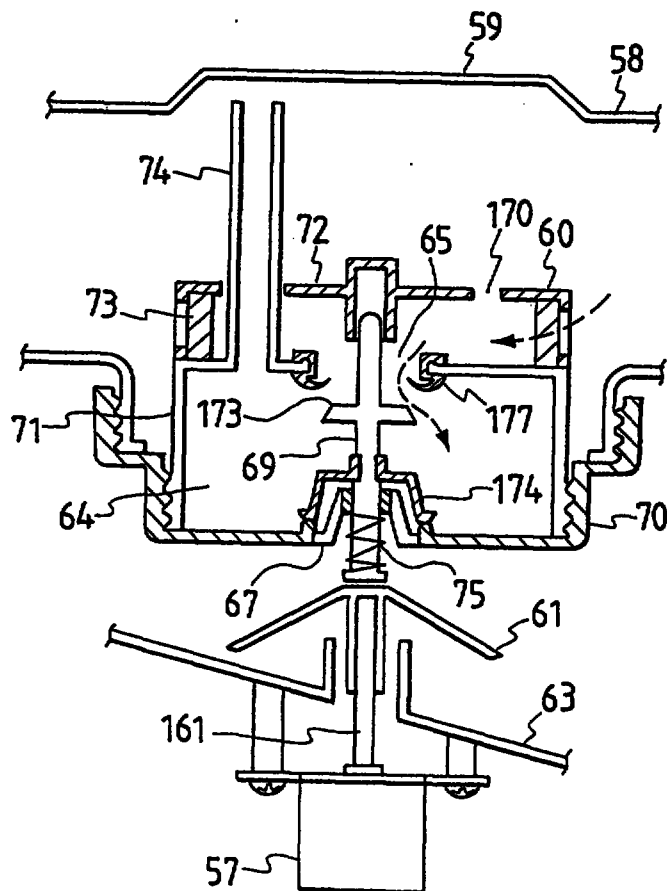




FIG. 17

[illegible]



FIG. 19

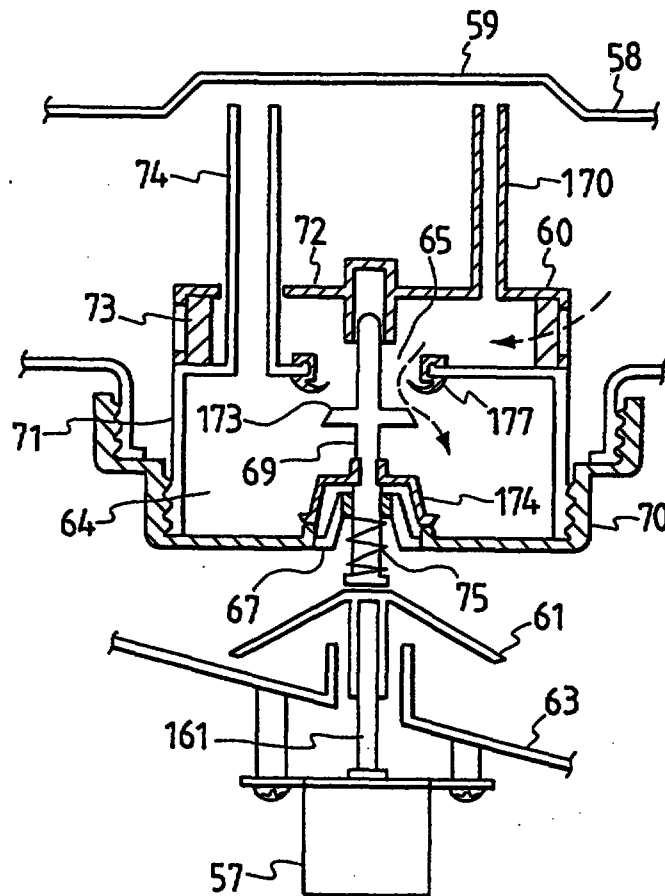


FIG. 20

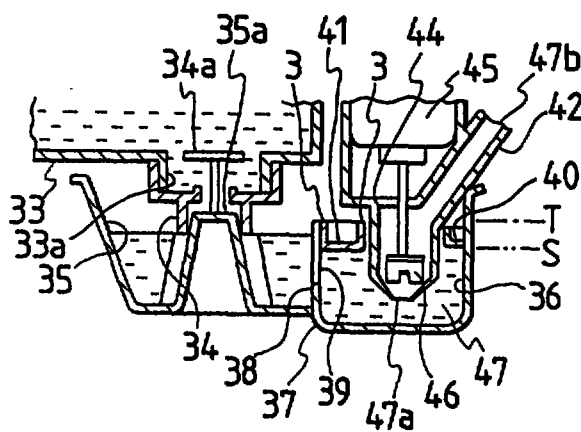
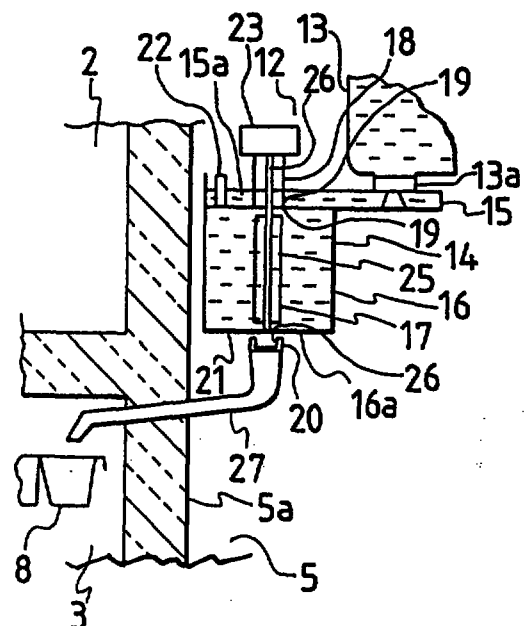


FIG. 21



REPLACEMENT SHEETS		SG
☒ Description	: paged 1 to paged 37	
☒ Claim(s)	: paged 38 to paged 41	
☒ Drawing(s)	: paged 1 to paged 12	
☒ Abstract	: paged 1 to paged 1	
DATE OF RECEIPT		29 NOV 1997

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WATER SUPPLYING APPARATUS FOR AN AUTOMATIC ICE MACHINE

The present invention relates generally to a water supplying apparatus for an automatic ice machine. More particularly, the present invention relates to a water supplying apparatus for an automatic ice machine for supplying water onto an ice making tray in an ice making compartment of a refrigerator.

Fig. 20 is a fragmentary sectional view of a conventional automatic ice machine which is disclosed in Unexamined Japanese Patent Publication Hei-3-137473. In the drawing, reference numeral 35 designates a water receiving container. The water receiving container 35 is composed of a measuring unit 36, a slit 39 and a receiving portion 35a. A water supply tank 33 including a valve 34a and a cap 34 is arranged in the receiving portion 35a. A pump 47 including a motor 46, an impeller 46, a case 44 and a water supply path 47b is arranged in the measuring unit 36. A mode of operation of the conventional automatic ice machine constructed in the aforementioned manner will be described below. The water stored in the water supply tank 33 is increasingly stored in the water receiving container 35 via the valve 34a, and subsequently, it enters the measuring container 36 through the slit 39. Although the water stored in the measuring unit 36 is pumped up at the time of water

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supplying, since the supplied water is caused to pass through the slit 39, a quantity of the water which has permeated through the slit 39 is small, resulting in water being supplied from the measuring unit 36 at a constant amount. Since the conventional water supplying apparatus is constructed in the above-described manner, water supplying can be achieved irrespective of how the water supplying apparatus and the ice making tray are located relative to each other in the vertical positional relationship. However, such apparatus is high in cost since the water pump is necessitated, and generates noisy sound.

In the circumstances as mentioned above, a water supplying apparatus for an automatic ice machine as illustrated in Fig. 21 is proposed as disclosed in Unexamined Japanese Patent Publication Hei-3-221769. In the drawing, reference numeral 3 designates an ice making compartment, reference numeral 5 designates a refrigerating compartment, reference numeral 8 designates an ice making tray, reference numeral 12 designates a water supplying apparatus, reference numeral 13 designates a water tank, reference numeral 14 designates a water storing container, reference numeral 15 designates a water receiving section, reference numeral 16 designates a water storing section, reference numeral 18 designates an inflow port, reference numeral 20 designates an outflow port, reference numeral 23 designates an electromagnetic solenoid, reference numeral 25 designates an inflow valve, reference numeral 26 designates an outflow valve, and reference numeral 27 designates a water supplying pipe. The water supplying apparatus 12 is arranged in the refrigerating compartment 5 and

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the ice making tray 8 is disposed in the ice making compartment 3 at the position lower than the water supplying apparatus 12 so that the water supplying apparatus 12 is communicated with the ice making tray 8 via the water supplying pipe 27. The water supplying apparatus 12 is substantially composed of the water tank 12, the water receiving container 14 and the water receiving section 15. Especially, upper and lower holes are formed on the water storing container 14, and the water supplying apparatus 12 includes as essential components the upper inflow port 18, the lower outflow port 20, the inflow valve 25 for closing the inflow port 18 therewith and the outflow valve 26 for closing the outflow port 20 therewith. The inflow port 18 is communicated with the water receiving section 15, and the outflow port 20 is communicated with the water supply pipe 27. The inflow valve 25 and the outflow valve 26 are operatively connected to each other, and both the valves 25 and 26 are electrically connected to the electromagnetic solenoid 23 disposed above the outflow valve 26 in such a manner that when the inflow port 18 is opened, the outflow port 20 is closed with the outflow valve 25 and when the inflow port 18 is closed, the outflow port 20 is opened. These operations can be performed by activating the electromagnetic solenoid 23.

Next, a mode of operation of the water supplying apparatus 12 constructed in the aforementioned manner will be described below. The water discharged from the water tank 19 is once stored in the water receiving section 15, and subsequently, it

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is introduced into the water storing section 16 via the inflow port 18. At this time, since the inflow valve 25 is opened and the outflow valve 26 is kept closed, water is continuously supplied into the water storing section 16 until the latter is fully filled with water. When the thus stored water is to be delivered to the ice making tray 8, the electromagnetic solenoid 23 is activated so that the outflow valve 26 is opened and the inflow valve 29 is closed. At this time, only the water stored in the water storing section 16 is caused to flow into the ice making tray 8 via the water supply pipe 27. Thus, water supplying can be achieved at a constant amount.

With each of the conventional water supplying apparatuses constructed in the above-described manner, the water stored in the water receiving section is exposed to the environmental air so that various kinds of bacilli floating in the air are adsorptively included in the stored water. Thus, when the stored water is kept still for a long time, there arise problems that the water tank and other components are covered with a film or layer of slime, and moreover, there is a high possibility that a sanitary quality of water stored in the water receiving section is degraded.

In addition, each conventional water supplying apparatus has another problems that the solenoid is wetted with the water

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which may flow along the rear surface of a conical member of the inflow valve, a frost appears on some part of the water supplying apparatus due to leakage of cold air from the ice making compartment to the refrigerating compartment under the influence of air stream, the open type water supply path is contaminated with foreign materials, and moreover, the absence of water fails to be detected.

Further, with each conventional water supplying apparatus, there arises a problem that the water stored in the water receiving section is soaked with an odor specific to a foodstuff stored in the refrigerator. With respect to the water supplying apparatus having a pump used therefor as disclosed in Unexamined Japanese Patent Publication Hei-3-137473, there arise problems that sound generated by rotation of the pump at the time of water supplying is noisy, the rotational speed of the pump fluctuates, and a measuring container is held in the inclined state due to the inclination of the refrigerator induced at the time of installation, causing the surface level of water in the measuring container to vary with the result that water supplying fails to be achieved at a constant rate.

The present invention has been made in consideration of the aforementioned problems and its object resides in providing a water supplying apparatus for an automatic ice machine wherein

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the arrangement of a water receiving section is eliminated so that there does not arise a malfunction that the water stored in a water receiving section is exposed to the environmental air, causing various kinds of bacilli floating in the air to be adsorptively included in the water.

Other object of the present invention is to provide a water supplying apparatus for an automatic ice machine wherein a solenoid section is not wetted with water at all, cold air does not flow from an ice making compartment to a refrigerating compartment, an open type water supply path is not contaminated with foreign materials, and any absence of water can be detected without fail.

Another object of the present invention is to provide a water supplying apparatus for an automatic ice machine wherein water supplying can be achieved at a constant rate at all times while generating a low level of sound.

According to the invention, there is provided a water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank disposed in an accomodating chamber different from said ice making compartment and located above the latter with a measuring unit also incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said outflow valve at the time of

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water inflow and close said inflow valve at the time of water outflow, and driving means disposed below said water tank for driving said valve assembly in order to open said outflow valve and close said inflow valve when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment.

Since the measuring chamber is disposed in the completely closed water tank, there does not arise a malfunction that various kinds of bacilli floating in the air are adsorptively included in the water stored in the water tank. Thus, there is little possibility that the water tank and other components are covered with a film or layer of slime, and moreover a sanitary quality of the water stored in the water tank is degraded. In addition, cleaning and maintenance services can easily be performed with the water supplying apparatus.

The driving means may include sealing means in the vicinity of said driving means so as to prevent said driving means from being wetted with the water stored in said water tank.

The arrangement may be such that a door switch mounted on a door of a refrigerator is opened or closed in operative association with said driving means such that said outflow valve is closed when said door is opened.

With such an arrangement, safety of the water supplying apparatus can be improved, and there is no possibility that the water tank is damaged or injured when it is forcibly taken out from the water tank accommodating chamber.

A water supply path may extend from the accommodating chamber to the ice making compartment and be designed in the form of an open type water supply path of

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which an outlet port is opened or closed by a float valve.

With such an arrangement, water supplying can be achieved not only when the water supplying apparatus and the ice making tray are positionally offset in the horizontal direction but also when it is difficult to extend a water supplying pipe around the water supply apparatus and other components. Further, there does not arise a malfunction that cold air leaks from the region between the ice making compartment and the refrigerating compartment.

The driving means for driving the valve assembly may be operable in the horizontal direction so that the outflow valve is opened or closed in the upward/downward direction via a connecting mechanism.

With such an arrangement, there is little possibility that the solenoid is wetted with water drops. Consequently, reliability of the water supplying apparatus can be improved with the water supplying apparatus.

A flexible member molded of a rubber and adapted to be displaced in operative association with the driving means may be fitted to a part of an open type water supply path extending from the accommodating chamber to the ice making compartment.

With such an arrangement since the solenoid and the open type water supply path are sealably arranged relative to each other using a flexible member molded of rubber, there is no possibility that the solenoid is wetted with water. Consequently, there does not arise a malfunction that actuation of the solenoid is interrupted by the invasion of the water in the solenoid.

A water reservoir may be disposed at the intermediate part of the water supply path extending from the accommodating chamber to the ice making compartment so as to prevent cold air from leaking therefrom.

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With such an arrangement, since the water reservoir is arranged at the intermediate part of the water supply path, there do not arise malfunctions that cold air leaks from the water supplying apparatus, and moreover, frosting is prevented around the water supplying apparatus.

The measuring chamber or the water tank and the open type water supply path may be sealably arranged so as to prevent cold air from leaking therefrom.

With such an arrangement, since the water tank and the water supply path are sealably arranged relative to each other by employing the sealing mechanism, there do not arise malfunctions that cold air leaks from the water supplying apparatus, and moreover, frosting is prevented around the water supplying apparatus.

A cleaning tray having the substantially same configuration as that of the open type water supply path may be placed on the open type water supply path so that it is fitted to one end of the flexible member molded of rubber.

With such an arrangement, since the cleaning tray having the substantially same configuration as that of the open type water supply path is placed on the water supply path, cleanability of the water supply apparatus can be improved.

A magnetic member may be displaceably received in the measuring chamber.

With such an arrangement, the absence of water can be detected when it is found that the lead switch is turned on for a time longer than a predetermined one.

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The water supply apparatus may further comprise a cap having the outflow hole formed thereon, an inner casing having the measuring chamber threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case fitted to the inflow hole side of the inner case and including the inflow valve molded of an elastic material such as a rubber or the like, an air venting hole formed at the upper part of the inner case and a water cleaning filter secured thereto, and a cooperating shaft held by the cap and the upper case to open and close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction, the cooperating shaft including the outflow valve molded of an elastic material such as a rubber or the like.

With such an arrangement, since the conventional water receiving section is eliminated and the measuring chamber is disposed in the completely closed water tank, there does not arise malfunctions that the water tank and other components are covered with a film or layer of slime, and moreover, a sanitary quantity of the water stored in the water tank is deteriorated without any soaking of foodstuff and water with unpleasant odour. In addition, since no pump is employed for the water supplying apparatus but water is supplied by activating the solenoid, any noisy sound attributable to rotation of the conventional pump is not generated with the water supplying apparatus. Consequently, the water supplying apparatus can practically be used at a low level of noise. Since both the inflow valve and the outflow valve are molded of an elastic material such as a rubber or the like, it is assured that the inflow valve is brought in close contact with the inflow hole when the water stored in the measuring chamber is supplied onto the ice making tray in the ice making compartment without any leakage of water in the measuring chamber. Thus, water supplying can be achieved at a constant rate at all times.

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When the actuating shaft of the solenoid is firmly held in the course of its working stroke for some reason while the solenoid is activated, it usually vibrates and generates a groaning sound. However, since the inflow valve is molded of an elastic material, it is geometrically deformed when it is brought in close contact with the inflow hole in the course of the working stroke of the actuating shaft of the solenoid. Thus, the actuating shaft of the solenoid completes its normal working stroke without generation of vibration and groaning sound. Further, in case that a small amount of water is stored in the water supply tank, there does not arise a malfunction that the inflow valve is floated up in the water supply tank.

The water supplying apparatus may further comprise a cap having the outflow hole formed thereon, an inner casing having the cap threadably secured thereto, the inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case disposed above the inner case and having an air venting hole formed thereon and a cleaning water filter secured thereto, and a cooperating shaft held by the cap and the upper case so as to allow it to be slidably displaced in the upward/downward direction, wherein the inflow/outflow valve fitted onto the cooperating shaft is molded of an elastic material such as a rubber or the like in order to open or close the inflow hole and the outflow hole by slidable displacement thereof in the upward/downward direction.

With such an arrangement, since the inflow valve and the outflow valve are integrated with each other in the form of an inflow/outflow valve which in turn is fitted onto the cooperating shaft, the water supplying apparatus can be fabricated using a small number of components at an inexpensive cost while preventing any water leakage due to incorrect fitting of the inflow valve as arising with the water supplying apparatus as discussed above.

The ceiling plate of the inner case may be inclined such that its height increases toward the air vent.

With such an arrangement, since the ceiling plate of the inner case is inclined such that its height gradually increases toward the air vent, no air remains below the ceiling plate of the inner case after the measuring chamber is filled with the water which has been introduced thereinto through the inflow hole. Thus, water supplying can be achieved at a constant rate at all times.

The air vent hole may be designed in the form of a cylindrical air vent standing upright from the upper case.

With such arrangement, since the air venting hole on the ceiling plate of the upper case is designed in the form of a cylindrical air vent standing upright therefrom, all water is caused to permeate through the water cleaning filter. Thus, the water supplying apparatus can exhibit an excellent water cleaning effect.

EMBODIMENTS

Embodiments of the present invention will now be described, by way of example, and with reference to Fig.1 to Fig.19 of the accompanying drawings, in which :-

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Fig. 1 is a whole front view of a refrigerator including a water supplying apparatus for an automatic ice machine constructed according to a first embodiment of the present invention.

Fig. 2 shows by way of sectional views the whole structure as well as the detailed structure of the water supplying apparatus for an automatic ice machine constructed according to the first embodiment of the present invention.

Fig. 3 is a schematic view of a control section for the water supplying apparatus for an automatic ice machine constructed according to a second embodiment of the present invention.

Fig. 4 shows by way of timing charts a mode of operation of the water supplying apparatus for an automatic ice machine constructed according to the second embodiment of the present invention.

Fig. 5 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a third embodiment of the present invention.

Fig. 6 is a fragmentary sectional view of the water supplying apparatus for an automatic ice machine constructed according to the third embodiment of the present invention, particularly showing a modified state of the water supplying apparatus.

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Fig. 7 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a fourth embodiment of the present invention.

Fig. 8 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a fifth embodiment of the present invention.

Fig. 9 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a sixth embodiment of the present invention.

Fig. 10 is a fragmentary sectional view of the water supplying apparatus for an automatic ice machine constructed according to the sixth embodiment of the present invention, particularly showing a modified state of the water supplying apparatus.

Fig. 11 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a seventh embodiment of the present invention.

Fig. 12 is a whole sectional view of a water supplying apparatus for an automatic ice machine constructed according to an eighth embodiment of the present invention.

Fig. 13 is a fragmentary sectional view of a water supplying apparatus for an automatic ice machine constructed according to a ninth embodiment of the present invention.

Fig. 14 is a schematic view of a controlling section for the water supplying apparatus for an automatic ice machine constructed according to the ninth embodiment of the present invention.

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Fig. 15 shows by way of timing charts a mode of operation of the water supplying apparatus for an automatic ice machine constructed according to the ninth embodiment of the present invention.

Fig. 16 shows by way of sectional views the whole structure as well as the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a tenth embodiment of the present invention.

Fig. 17 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to an eleventh embodiment of the present invention.

Fig. 18 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a twelfth embodiment of the present invention.

Fig. 19 shows by way of sectional view the detailed structure of a water supplying apparatus for an automatic ice machine constructed according to a thirteenth embodiment of the present invention.

Fig. 20 is a sectional view of a conventional ice machine.

Fig. 21 is a sectional view of another conventional ice machine.

A first embodiment of the present invention will be described below with reference to Fig. 1 and Fig. 2. In Fig. 1, reference numeral 51 designates a refrigerating compartment, and reference numeral 52 designates an ice making compartment. A door switch 62 is disposed on a partition plate 62 interposed between the refrigerating compartment 61 and the ice making compartment. In addition, a water supply tank corner 54 is disposed at the lower stage of the refrigerating compartment 51, and an ice machine 55 is disposed in the ice making compartment 52.

Referring to Fig. 2, a water supply path 63 including a water tank assembly 58 having a measuring unit 60 incorporated therein, a solenoid 57 and a conical member 61 is arranged in the water supply corner 54. The solenoid 57 serves as driving means and it is located outside of the water supply path 63 in such a manner that its actuating shaft extends through the wall for the water supply path 63 to enter the interior of the water supply path 63 while it is displaceable in the upward/ downward direction. The conical member 61 is attached to the foremost end of the actuating shaft of the solenoid 57 to serve as sealing means, and it is molded of a silicone based material. Further, the conical member 61 is located in vertical alignment with the lower end of a cooperating shaft 69 in the coaxial relationship. An ice making tray 66 is disposed below the water supply path 63 in the ice making compartment 52. The

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water tank assembly 68 is composed of a water tank 59 and a cap 70 having the measuring unit 60 incorporated therein. The measuring unit 60 includes an inner case 71 having an outflow hole 67, an inflow hole 65 and an air venting hole 74 formed thereon, an upper case 72 including an active carbon 73 and an inflow valve 66 disposed in the inner case 71 on the inflow hole 65 side so as to allow the inflow hole 65 to be closed with the inflow valve 66. An outflow valve 68 adapted to close the outflow hole 67 therewith, a cooperating shaft 69 for integrating both the valves 66 and 68 with each other and a spring 75 located on an extension of the cooperating shaft 69 on the outflow valve 67 side are arranged on the outflow hole 67 side. While any force is not exerted on the cooperating shaft 69 from below, both the inflow valve 66 and the outflow valve 68 are lowered by the resilient force of the spring 75 so that the inflow hole 65 is kept opened but the outflow hole 67 is closed with the outflow valve 68. When the solenoid 57 disposed outside of the water supply path 63 is activated, the conical member 61 is displaced in the upward direction so that the cooperating shaft 69 is upwardly thrust from below. While the force given by the conical member 61 is exerted on the cooperating shaft 69 from below, the spring 75 is contracted and both the inflow valve 66 and the outflow valve 68 are raised up, whereby the inflow hole 65 is closed with the inflow valve 66 but the outflow hole 67 is kept opened. The upper

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case 72 is fixedly secured to the inner case 71 by tightening screws or by fitting the former into the latter.

Next, a mode of operation of the water supplying apparatus constructed in the aforementioned manner will be described, below with reference to Fig. 1 and Fig. 2. While the solenoid 57 is not activated, the conical member 61 is lowered. At this time, the spring 75 is caused to expand so as to allow the cooperation shaft 69 to be lowered. Since the inflow hole 65 is kept opened at this time, the water stored in the water tank 59 permeates through the active carbon 73 to enter the upper case 72; and subsequently, it enters the measuring chamber 64 through the inflow hole 65. However, since the outflow hole 67 is closed with the outflow valve 68, the measuring chamber 64 is fully filled with water. At this time, the air vent 74 permits water to smoothly flow therethrough via the inflow hole 65. Subsequently, when the solenoid 57 is activated, the conical member 61 is upwardly displaced to come in contact with the cooperating shaft 69 which in turn is raised up until the inflow hole 65 is closed with the inflow valve 66. Since the outflow hole 67 is opened at this time, the water stored in the measuring chamber 64 is discharged through the outflow hole 67 without any additional supplement of water from the water tank 59. Thus, since only the water stored in the measuring chamber 64 is caused to flow to the ice making tray 56 via the water supply path 63, water supplying can be achieved at a constant

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rate but it can not be achieved within a constant period of time because no air venting hole is formed in connection with the outflow hole 67. In other words, although the outflow time fluctuates when the solenoid 57 is activated for a long time, water supplying can be achieved at a constant rate at all timed.

Since all water is supplied from the completely closed water tank 59 without any opportunity to be exposed to the environmental air, few bacillus floating in the air is adsorptively included in water, resulting in various kinds of bacilli failing to be grown in water. In addition, since the cap 70 is dimensioned to have a large diameter enough to allow an operator's hand to be put in the cap 70, the interior of the water tank 59 can easily be cleaned with his hand. Further, since the solenoid 57 having electrical connection to the outside is arranged independently of the water tank assembly 68, it is possible to freely take out the water tank assembly 68 from the water tank corner 54. Thus, cleaning and maintenance services can be performed easily.

Since the conical member 61 is molded of a silicone based material, there is no possibility that water is introduced into the solenoid 57, and moreover, no noisy sound is generated when the conical member 61 is brought in contact with the outflow valve 68 via the cooperating shaft 69.

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Embodiment 2

Although the first embodiment of the present invention has been described above with respect to the case that the solenoid 57 is independently activated, Fig. 3 and Fig. 4 show a second embodiment wherein the solenoid 57 is activated in operative association with a door switch 62. Fig. 3 is a schematic illustrative view which shows the arrangement of the door switch 57 and Fig. 4 is a diagram which shows timing charts. Referring to Fig. 3, a refrigerator includes a control base board 76 to which the solenoid 57 and the door switch 61 are electrically connected. On the other hand, the control base board 76 is electrically connected to a power source 77 for the purpose of power supply. As shown in Fig. 4, the timing relationship is determined such that when a water supply start signal is outputted from the control base board 76, the solenoid 67 is turned on for a predetermined time, and subsequently, it is turned off when the door switch 62 is opened.

It is assumed that while the solenoid 57 is activated, a door (not shown) is opened so as to take out a water tank assembly 58 from the water supply tank corner 54. Provided that the solenoid 57 is turned on and a conical member 61 is raised up at this time, there is a possibility that a cap 70 or the conical member 61 is damaged or an actuation shaft of the solenoid 57 deflects due to the contact of the conical member 61 with the cap 70. However, since the door switch 62 is

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actuated in operative association with the solenoid 57 via the door, when the door is opened, the conical member 61 is lowered, causing the outflow hole 67 to be closed with the outflow valve 68. Thus, the water tank assembly 58 can be taken out from the water supply tank corner 54 without an occurrence of damage or injury thereof.

Embodiment 3.

In the aforementioned embodiments, the ice making compartment 52 is communicated directly with the refrigerating compartment 51 without any sealing means interposed therebetween. For this reason, there is a possibility that cold air leaks from the water supplying apparatus, resulting in a frost arising at some part of the water supply apparatus. To cope with the foregoing malfunction, a measure is taken according to a third embodiment of the present invention as illustrated in Fig. 5. Specifically, as shown in Fig. 5, the intermediate part of a water supply path 63 is exploded so that a float case 81 is placed at the exploded part of the water supply path 63 with a float 80 disposed at an outlet port of the float case 81.

With this construction, the ice making compartment 52 is separated from the refrigerating compartment 51 with the float 80 interposed therebetween. As water flows in the float case 81, the float 80 is raised up by the action of buoyancy. Thus,

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after a small amount of water is stored in the float case 31, it is caused to flow through the water supply path 63. In other words, water flow is assured while preventing any cold air from leaking from the water supplying apparatus.

In the preceding embodiment, the float 80 is disposed at the intermediate part of the water supply path 63. Alternatively, as shown in Fig. 6, the float 80 may be connected to the conical member 61 via a connecting rod 82 so as to exhibit the same function as that in the preceding embodiment. Specifically, when the solenoid 57 is turned off, the conical member 61 is lowered, causing the connecting rod 82 to be likewise lowered until the water supply path 63 is closed with the float 80. Thus, communication between the ice making compartment 52 and the refrigerating compartment 51 is interrupted by the float 80 to prevent cold air from leaking from the water supplying apparatus. While the solenoid 57 is turned on, i.e., water flows through the outflow hole 67, the conical member 61 is raised up, causing the connecting rod 82 to be likewise raised up, resulting in the water flowing through the water supply path 63.

Embodiment 4

In the aforementioned embodiments, since the solenoid 57 is activated so as to allow the conical member 61 to be displaced in the upward/downward direction, there is a possibility that

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a part of water leaks in the form of water drops from the location where the conical member 61 is connected to the solenoid 57 via the actuation shaft, resulting in reliability on the activation of the solenoid 57 being degraded. To cope with the foregoing malfunction, a measure is taken according to a fourth embodiment of the present invention as illustrated in Fig. 7. Referring to Fig. 7, a spring 84 is interposed between the conical member 61 and the water supply path 63, and the lower end of the conical member 61 comes in contact with one end of a L-shaped arm 83 of which other end is pivotally connected to the solenoid 57 which is arranged with a horizontal attitude.

While the solenoid 57 is turned off, the conical member 61 is lowered by the resilient force of the spring 84. Subsequently, when the solenoid 57 is turned on, the arm 83 turns about a fulcrum in the clockwise direction to raise up the conical member 61 while compressing the spring 84. Consequently, also in this embodiment, the solenoid 57 serves in the same manner as in the aforementioned embodiments wherein it is activated in the upward/downward direction.

Embodiment 5.

Referring to Fig. 8, a flexible conical member 90 molded of a rubber is operatively connected to the solenoid 57 so as to be raised up and lowered in operative association with the

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solenoid 57, and a shaft of the solenoid 56 extends through a hole which is formed through an open type water supply path 63.

Since the flexible conical member 90 is molded of a rubber, not only when the solenoid 57 is activated so as to allow the conical member 90 to be raised up to the position as represented by reference character B but also when it is activated so as to allow the conical member 90 to be lowered to the position as represented by reference character A, there does not arise a malfunction that the conical member 90 is disconnected from the periphery of the hole formed at the intermediate position of the water supply path 63. In other words, there is no possibility that water enters the solenoid 57 irrespective of how the solenoid 57 is activated.

Embodiment 6

In the fifth embodiment as mentioned above, since the ice making compartment 52 is communicated directly with the refrigerating compartment 51 without any sealing means interposed therebetween, there is a possibility that cold air leaks from the water supplying apparatus, causing a frost to appear at some part of the water supplying apparatus. To cope with the foregoing malfunction, a measure is taken according to a sixth embodiment of the present invention as illustrated in Fig. 9. Specifically, as shown in Fig. 9, a trap 92 (serving

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as a water reservoir) is disposed at the intermediate position of the water supply path 63.

With this construction, as the trap 92 is filled with water, an extra amount of water flows out of the trap 92, through the water supply path 63 while preventing cold air from leaking from the ice making compartment 52 and the refrigerating compartment 51.

In this embodiment, the trap 92 is arranged such that it is integrated with a part of the water supply path 63. In case that the foregoing arrangement is practically impossible, it is recommendable that a trap cover 93 is placed at the intermediate part of the water supply path 63 and a trap 92 is formed in cooperation with the trap cover 93 as shown in Fig. 10(a). Fig. 10(b) is a perspective view of the trap 92, particularly showing the structure of the trap cover 93. As water flows in the trap 92 via the trap cover 93 until the trap 92 is filled with water, an extra amount of water flows out of the trap 92 while preventing cold air from leaking from the water supplying apparatus. Fig. 10(c) is a fragmentary sectional view of the water supply path 63, particularly showing that the trap cover 93 is firmly held on the water supply path 63 by fitting an annular projection on the trap cover 93 into the corresponding recess on the water supply path 63.

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Embodiment 7

In the aforementioned embodiments, the water supply path 63 is utilized as sealing means for sealably isolating the ice making compartment 52 from the refrigerating compartment 51.. In contrast with them, this embodiment is intended to utilize the fitting region where the cap 70 is fitted into the water supply path 63 as illustrated in Fig. 11. Specifically, referring to Fig. 11, an annular cap sealing rib 95 extending downward of the cap 70 is fitted into a water supply path sealing rib 94 extending upward of the water supply path 63 when the cap 70 and the water supply path 63 are assembled with each other by fitting the former into the latter.

With this construction, since the water supply path sealing rib 94 is loaded with the dead weight of the whole water tank assembly 58 inclusive of the cap 70, there does not arise a malfunction that cold air leaks from the water supplying apparatus. In other words, water flows through the water supply path 63 without an occurrence of leakage of the cold air. When the cap 70 is dimensioned to have a thickness t_2 much larger than a thickness t_1 of the water tank 59, it is assured that the cap 70 can be kept flat no matter how the water tank 59 is distorted. In addition, since the water tank assembly 58 is heavy, there does not arise a malfunction that an annular gap appears between the water supply path sealing

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rib 94 and the cap sealing rib 95 due to the heavy dead weight of the water tank assembly 58 itself irrespective of whether the tank 59 is filled with water or not. As shown in Fig. 11(b), it is recommendable that an annular packing 102 is fitted onto the water supply path sealing rib 94 in order to exhibit an additional sealing effect with the packing 102. Obviously, an annular packing (not shown) similar to the packing 102 may be fitted onto the cap sealing rib 95 for the same purpose.

Embodiment 8

In the aforementioned embodiments as shown in Fig. 8 to Fig. 10, one end of the flexible conical member 90 molded of a rubber is fitted to a part of the open type water supply path 63. Fig. 12 illustrates an embodiment wherein the conical member 90 is fitted to another member. Specifically, as shown in the drawing, a cleaning tray 91 having the substantially same configuration as that of the open type water supply path 63 is placed on the water supply path 63, and one end of the flexible conical member 90 is fitted to the cleaning tray 91.

With this construction, since the flexible conical member 90 is fitted to the cleaning tray 91 but not to the water supply path 63, as water flows out of the water tank assembly 58, it passes by the conical member 90 and flows along the cleaning tray 91 to reach the ice making compartment 52 without

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any entrance of the water in the solenoid 57 and the open type water supply path 63. Thus, this embodiment is preferably employable not only from the viewpoint of quality of a product of ice but also from the viewpoint of a sanitary engineering.

Embodiment 9

In the aforementioned embodiments, it is not detected whether water is present in the water tank assembly 58 or not. Fig. 13 illustrates an embodiment wherein water absence detecting means is arranged in the water tank assembly 58. As shown in the drawing, a water absence detecting case 96 is firmly placed on the cap 70, and a plurality of inflow/outflow holes 100 are formed through the water absence detecting case 96 at the upper part as well as the lower part of the latter. A water absence detecting ball 97 having a magnet incorporated therein is received in the water absence detecting case 96 such that it can be displaced in the upward/downward direction as seen in the drawing. A lead switch 99 is attached to the water supply path 63 at the lower position located opposite to the magnet 98.

With this construction, when water is temporarily absent in the cap 70, the water absence detecting ball 97 is lowered in excess of a predetermined lower position, causing the lead switch 99 to be turned on. On receipt of a signal from the lead switch 99, the cap 70 is immediately supplied with water

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so that the lead switch 99 is turned off because the water absence detecting ball 97 is raised up by the action of buoyancy. However, when water completely disappears from the interior of the cap 70 for some reason, the lead switch 99 is turned off for a longer time. In these circumstances, a controller (not shown) in the control base board 76 determines that no water is present in the water tank assembly 58 when the lead switch 99 is turned off for a time longer than a predetermined time (t).

Fig. 14 is a schematic illustrative view which shows a wiring system for the water supplying apparatus, and Fig. 15 is a diagram which shows several timing charts. Referring to Fig. 14, the lead switch 99 and a light emitting diode 101 adapted to be illuminated for indicating a command of water supply are electrically connected to the control base board 76, and when the controller determines that no water is present in the water tank assembly 58, the light emitting diode 101 is illuminated (the position where the water supplying apparatus is disposed is not shown in the drawing).

Embodiment 10

Next, a tenth embodiment of the present invention will be described below with reference to Fig. 16. As shown in the drawing, a water tank assembly 58 inclusive of a measuring unit 60 and a water supply path 63 inclusive of a solenoid 57 and a

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conical member 61 are arranged in the water supply tank corner 54, and the solenoid 57 is disposed outside of the water supply path 63. An actuating shaft 161 of the solenoid 57 extends through a wall of the water supply path 63 until it is exposed to the interior of the water supply path 63. The conical member 61 is attached to the foremost end of the actuating shaft 161. An ice making tray 56 is disposed in the ice making compartment 52 at the position located below the water supply path 63. The water tank assembly 58 and the measuring unit 60 are placed on a cap 70 having an outflow hole 67 formed thereon. In addition, the water supplying apparatus includes an inner case 71 having an inflow hole 65 formed thereon and including a measuring chamber 64 and a cylindrical air vent 74, an inflow valve seat 177 molded of an elastic material such as a rubber or the like and adapted to be fitted into the inflow hole 65, an upper case 72 including a water cleaning filter 73 and having an air vent hole 170 formed on a ceiling plate thereof, and a cooperating shaft 69 slidably displaceable in the upward/downward direction. A circular disc 173 is made integral with the cooperating shaft 69 at the intermediate position of the latter, an outflow valve 174 adapted to close an outflow hole 67 therewith is disposed below the circular disc 173, and moreover, a spring 75 is disposed below the outflow valve 174 in such a manner that the cooperating shaft 69 is located in vertical alignment with the actuating shaft 161 of the solenoid 57 along a common axis. While no force is

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exerted on the cooperating shaft 69 from below, the circular disc 173 is lowered by the resilient force of the spring 75 so that the inflow hole 65 is opened but the outflow hole 67 is closed with the outflow valve 174. When the solenoid 57 disposed outside of the water supply path 63 is activated, the conical member 61 is displaced in the upward direction and the cooperating shaft 69 is then raised up by the conical member 61 from below. While the cooperating shaft 69 is raised up by the force given the conical valve 61 from below, the spring 75 is contracted and the circular disc 173 is raised up to come in close contact with the inflow valve seat 177 so as to close the inflow hole 65 with the inflow valve seat 177 while the outflow hole 67 is kept opened. The upper case 72 is fixedly secured to the intermediate case 71 by tightening screws or by fitting the former onto the latter, and the intermediate case 71 is fixedly secured to the cap 70 by tightening screws.

Next, a mode of operation of the water supplying apparatus constructed in the aforementioned manner will be described below. While the solenoid 57 is not activated, the conical member 61 is lowered, the spring 75 is caused to fully expand, and the cooperating shaft is also lowered. Since the inflow hole 65 is kept opened at this time, water flows in the upper case 72 through the water cleaning filter 73, and subsequently, it flows in the measuring chamber 64 through the inflow hole 65 until the measuring chamber 64 is filled with water, because

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the outflow hole 67 is closed with the outflow valve 174. At this time, the air vent 74 assures that water is smoothly introduced into the measuring chamber 64 through the inflow hole 65. Next, when the solenoid 57 is activated, the conical member 61 is raised up and the cooperating shaft 69 is also raised up in operative association with the conical member 61. Thus, the circular disc 173 is brought in close contact with the inflow valve seat 177 to close the inflow hole 65 with the circular disc 173, and the outflow hole 67 is opened. This causes the water stored in the measuring chamber 64 to be discharged through the outflow hole 67 but no water is supplied from the water tank 69 at this time. For this reason, a predetermined quantity of water stored only in the measuring chamber 64 is delivered to the ice making tray 56 via the water supply path 63. In other words, constant water supplying is achieved at a predetermined rate. Since the inflow valve seat 177 is molded of an elastic material, when the circular disc 173 is brought in close contact with the inflow valve seat 177 in the course of a working stroke of the actuating shaft 161 of the solenoid 57, the inflow valve seat 177 is elastically deformed, enabling the actuating shaft 161 of the solenoid 57 to be raised up by a distance corresponding to a specified working stroke thereof not only without any generation of vibration and unpleasant groaning sound but also without an occurrence of leakage of water from the measuring chamber 64. Since water is supplied only from the completely closed water

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tank assembly 58 without any exposure to the environmental air during water supplying, few bacillus floating in the air is adsorptively included in the supplied water. As a result, few growth of bacillus is recognized with the supplied water, whereby soaking of a foodstuff with certain odor via the supplied water to be frozen can be prevented.

An air vent hole 170 formed through the upper case 72 is intended to vent the air in the upper case 72 therethrough. Since a certain quantity of air remains in the upper case 72 and the measuring chamber 64 after the cap 70 is fitted to the water tank assembly 58 which in turn is filled with water, the remaining air is vented to the water tank 59 through the air vent hole 170 in order to assure that the water stored in the water tank 59 is smoothly introduced into the upper case 72 through the water cleaning filter 73.

Embodiment 11

In the preceding embodiment, the inflow valve seat 177 is disposed on the inflow hole 65 side of the inner case 71. Fig. 17 illustrates an embodiment wherein the inflow valve seat 177 is integrated with the outflow valve 174.

In the drawing, reference numeral 178 designates an inflow/outflow valve which is molded of an elastic material such as a rubber or the like. The inflow/outflow valve 178 is fitted onto a cooperating shaft 69. As the cooperating shaft 69 is slidably displaced in the upward/downward direction, the

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inflow hole 65 is closed but the outflow valve 67 is opened and vice versa. With this construction, the same functional effect as that in the tenth embodiment is obtainable with the water supplying apparatus. Thus, the water supplying apparatus can be fabricated with a reduced number of components at an inexpensive cost without any possibility that water leaks from the inflow valve seat 177 due to incorrect fitting of the latter which may occur in the fifth embodiment.

Embodiment 12

In each of the tenth and eleventh embodiments, since the ceiling plate of the inner case 71 is designed to be flat, some amount of air is liable to remain in the form of air bubbles in the space below the ceiling plate of the inner case 71, causing a quantity of water stored in the measuring chamber 64 to readily fluctuate. To cope with the foregoing malfunction, a measure is taken according to a twelfth embodiment of the present invention as illustrated in Fig. 18. As shown in the drawing, in this embodiment, an inclined ceiling plate 179 of which height increases toward the air vent 74 is substituted for the flat ceiling plate in each of the preceding embodiments. With this construction, all the air bubbles remaining below the inclined ceiling plate 179 are collected in the air vent 74 and then discharged to the water tank 69 through the air vent 74. Thus, the measuring chamber 64 is

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fully filled with water without any remaining air, resulting in water supplying being achieved at a constant rate at all times.

Embodiment 13

In each of the tenth, eleventh and twelfth embodiments, the, air vent hole 170 is formed through the ceiling plate of the upper case 72 so as to allow the air remaining in the upper case 72 to be vented therethrough. With this construction, since all the water stored in the water tank 59 does not permeate through the water cleaning filter 73 but a part of the water enters the upper case 72 through the air vent hole 170 to reach the measuring chamber 64, there arises a malfunction that the water cleaning filter 73 can not fully exhibit its own functional effect. To cope with the foregoing malfunction, a measure is taken according to a thirteen embodiment of the present invention as illustrated in Fig. 13.

In the drawing, reference numeral 170 designates a cylindrical air vent which stands upright from the ceiling plate of the upper case 72. Since the air bent 170 is dimensioned to have a height higher than the surface level of water in the water tank 59, all the water in the water tank 59 is caused to permeate through the water cleaning filter 73. This makes it possible for the water cleaning filter 73 to fully exhibit its water filtering capability.

KEY TO REFERENCE NUMERALS

51	refrigerating compartment
52	ice making compartment
56	ice making tray
57	solenoid
59	tank
60	measuring mechanism
61	conical member
62	door switch
63	water supplying compartment
64	measuring chamber
65	inflow hole
66	inflow valve
67	outflow hole
68	outflow valve
69	cooperating shaft
74	air vent
80	float
82	connecting rod

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90	conical member molded of a rubber
91	cleaning tray
92	trap
93	trap cover
94	water supply path sealing rib
95	cap sealing rib
96	water absence detecting case
97	water absence detecting ball
98	magnet
99	lead switch
161	actuating shaft
170	air venting hole
173	circular disc
174	outflow valve
177	inflow valve
178	outflow/inflow valve
179	inclined surface

CLAIMS

1. A water supplying apparatus for an automatic ice machine arranged in an ice making compartment to supply water onto an ice making tray in said ice making compartment, characterized in that said water supplying apparatus comprises a water tank disposed in an accommodating chamber different from said ice making compartment and located above the latter with a measuring unit also incorporated therein, said measuring unit including a valve assembly comprising an inflow valve and an outflow valve corresponding to an inflow hole and an outflow hole in such a manner as to close said outflow valve at the time of water inflow and close said inflow valve at the time of water outflow, and driving means disposed below said water tank for driving said valve assembly in order to open said outflow valve and close said inflow valve when the water stored in a measuring chamber of said measuring unit is supplied onto said ice making tray in said ice making compartment.
2. A water supplying apparatus according to Claim 1, wherein said driving means includes sealing means in the vicinity of said driving means so as to prevent said driving means from being wetted with the water stored in said water tank.
3. A water supplying apparatus according to Claim 1 or 2, wherein a door switch mounted on a door of a refrigerator is opened or closed in operative association with said driving means such that said outflow valve is closed when said door is opened.
4. A water supplying apparatus according to any preceding claim, wherein a water supply path extending from said accommodating chamber to said ice making compartment is designed in the form of an open type water supply path of which an outlet port is opened or closed by a float valve.



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5. A water supply apparatus for an automatic ice machine as claimed in any preceding claim, characterised in that said driving means for driving said valve assembly is operable in the horizontal direction and said outflow valve is opened or closed in the upward/downward direction via a connecting mechanism.
6. A water supply apparatus according to any preceding claim, wherein a flexible member molded of a rubber and adapted to be displaced in operative association with said driving means is fitted to a part of an open type water supply path extending from said accommodating chamber to said ice making compartment.
7. A water supplying apparatus for an automatic ice machine as claimed in Claim 6, characterized in that a water reservoir is disposed at the intermediate part of said water supply path extending from said accommodating chamber to said ice making compartment so as to prevent cold air from leaking therefrom.
8. A water supplying apparatus for an automatic ice machine as claimed in Claim 6, characterized in that said measuring chamber or said water tank and said open type water supply path are sealably arranged so as to prevent cold air from leaking therefrom.
9. A water supply apparatus for an automatic ice machine as claimed in Claim 6, characterized in that a cleaning tray having substantially the same configuration as that of said open type water supply path is placed on said open type water supply path so that it is fitted to one end of said flexible member molded of a rubber.
10. A water supplying apparatus for an automatic ice machine as claimed in Claim 6, characterized in that a magnetic member is displaceably received in said measuring chamber.



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11. A water supplying apparatus according to Claim 1 and comprising a cap having said outflow hole formed thereon, an inner case having said measuring chamber threadably secured thereto, said inflow hole formed thereon and a cylindrical air vent standing upright therefrom, an upper case fitted to the inflow hole side of said inner case and including said inflow valve molded of an elastic material such as a rubber or the like, an air venting hole formed at the upper part of said inner case and a water cleaning filter secured thereto, and a cooperating shaft held by said cap and said upper case to open and close said inflow hole and said outflow hole by slidable displacement thereof in the upward/downward direction, said cooperating shaft including said outflow valve molded of an elastic material such as a rubber or the like.
12. A water supplying apparatus according to Claim 1 and comprising a cap having said outflow hole formed thereon, an inner case having said cap threadably secured thereto, said inflow hole formed thereon and a cylindrical air vent standing upright therefrom, and an upper case disposed above said inner case and having an air venting hole formed thereon and a water cleaning filter secured thereto, and a cooperating shaft held by said cap and said upper case so as to allow it to be slidably displaced in the upward/downward direction, wherein said inflow/outflow valve fitted onto said cooperating shaft is molded of an elastic material such as a rubber or the like in order to open or close said inflow hole and said outflow hole by slidable displacement thereof in the upward/downward direction.
13. A water supplying apparatus for an automatic ice machine as claimed in Claim 11 or Claim 12, characterized in that the ceiling plate of said inner case is inclined such that its height increases toward said air vent.
14. A water supplying apparatus for an automatic ice machine as claimed in Claim 11 or claim 12, characterized in that said air vent hole is designed in the form of a cylindrical air vent standing upright from said upper case.

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15. A water supplying apparatus substantially as herein described with reference to Figures 1 to 4, 5 and 6, 7, 8, 9 and 10, 11, 12, 13 to 15, 16, 17, 18 or 19 of the accompanying drawings.

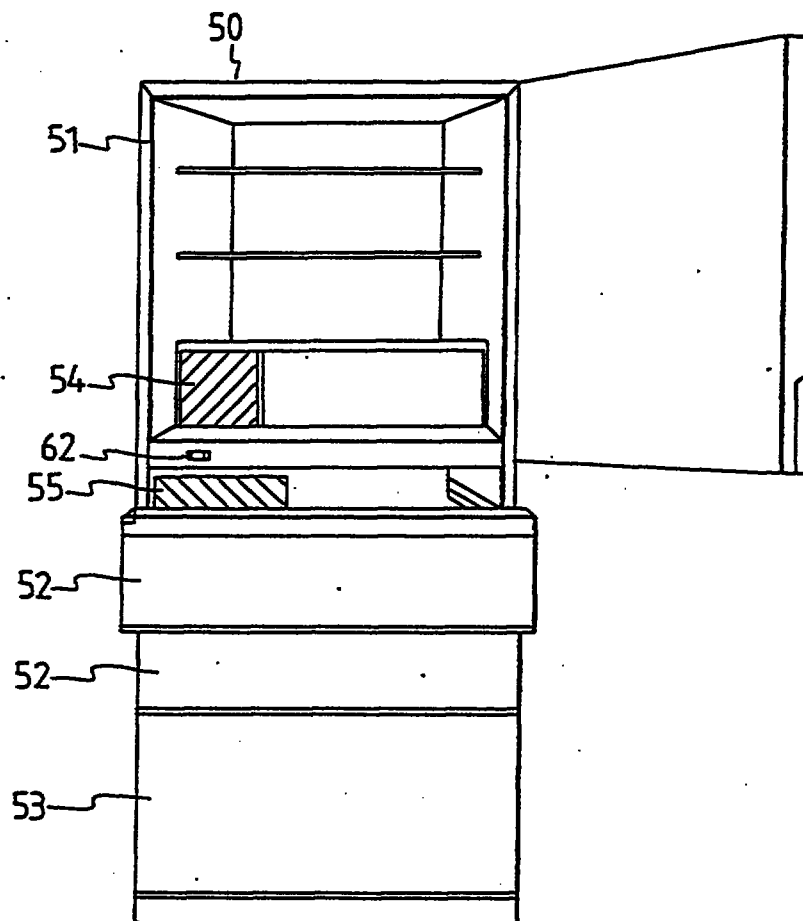


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FIG. 1



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FIG. 2A

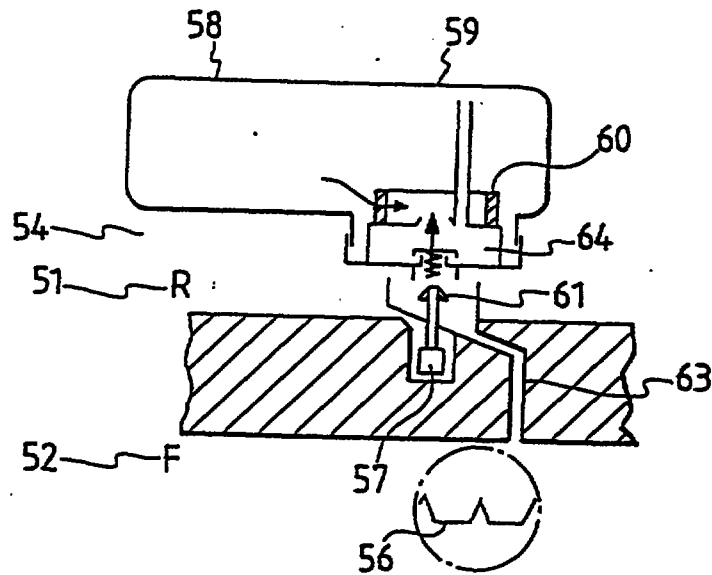
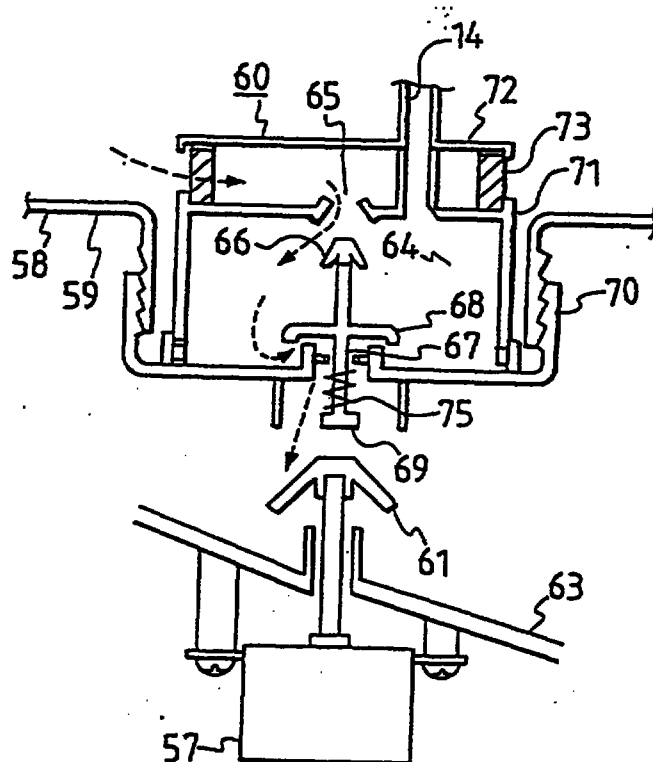


FIG. 2B



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FIG. 3

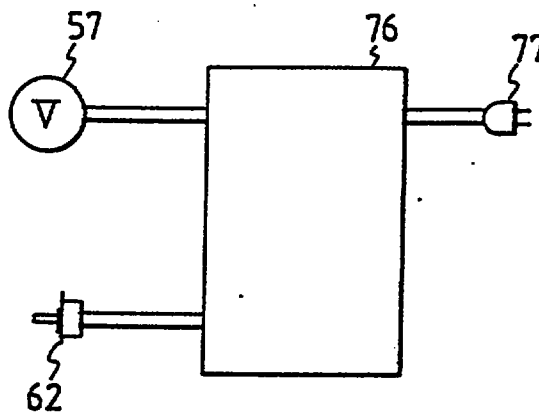
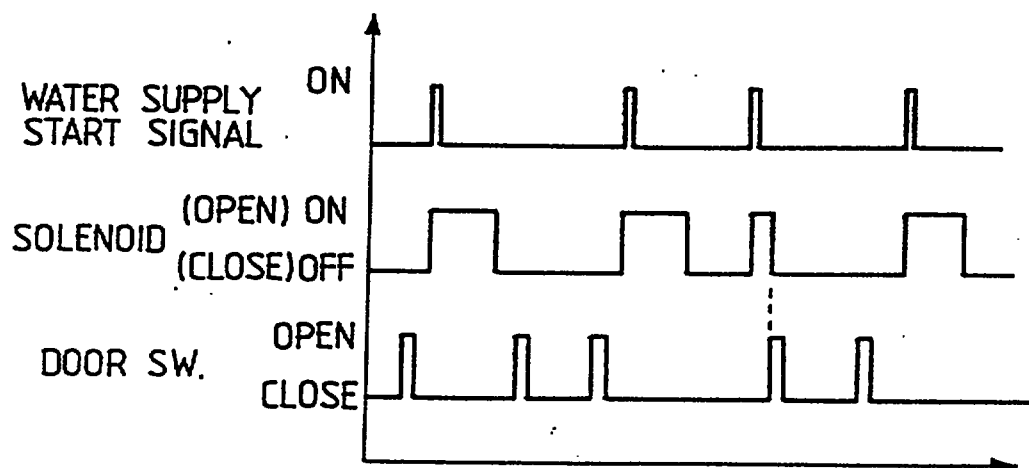


FIG. 4



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FIG. 5

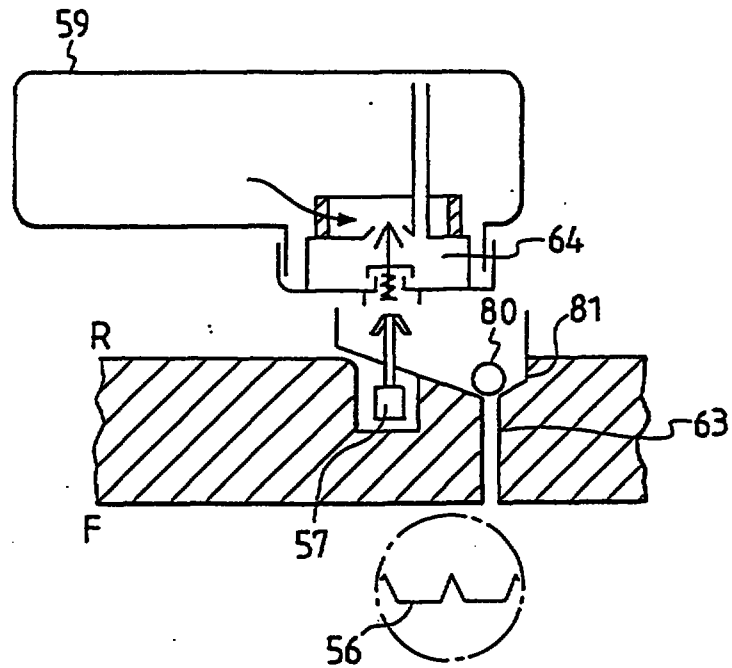
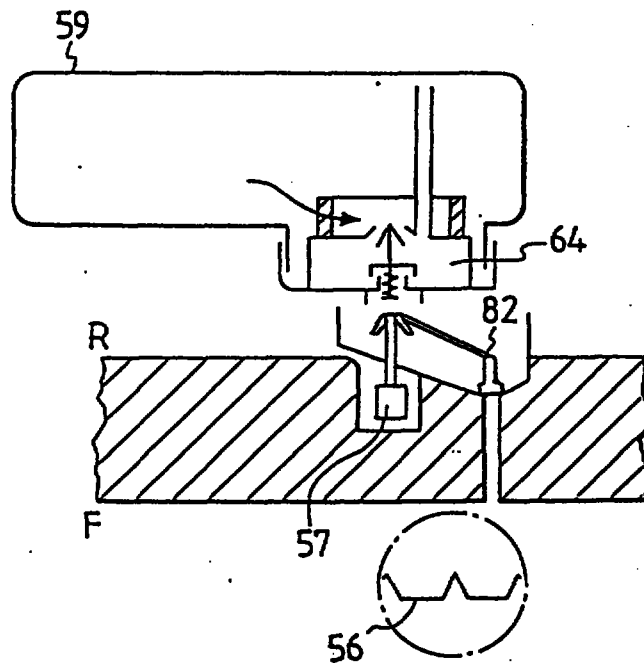


FIG. 6



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FIG. 7

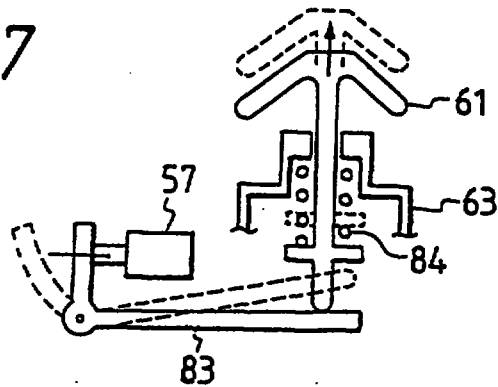


FIG. 8

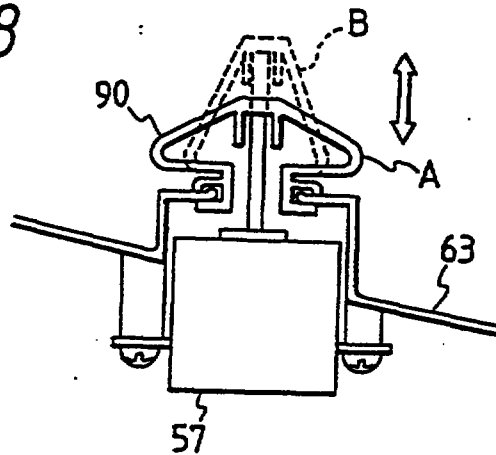
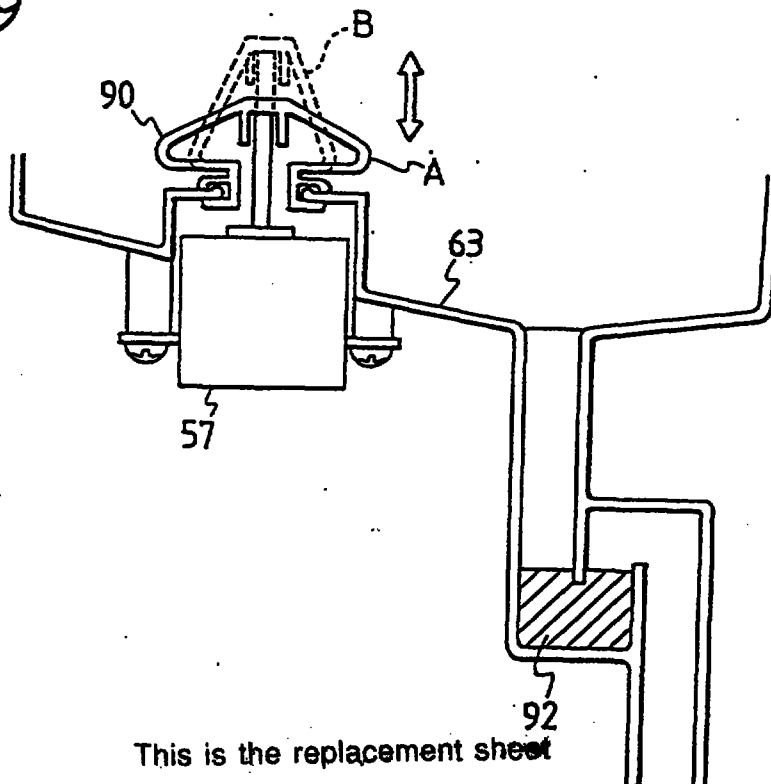


FIG. 9



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FIG. 10A

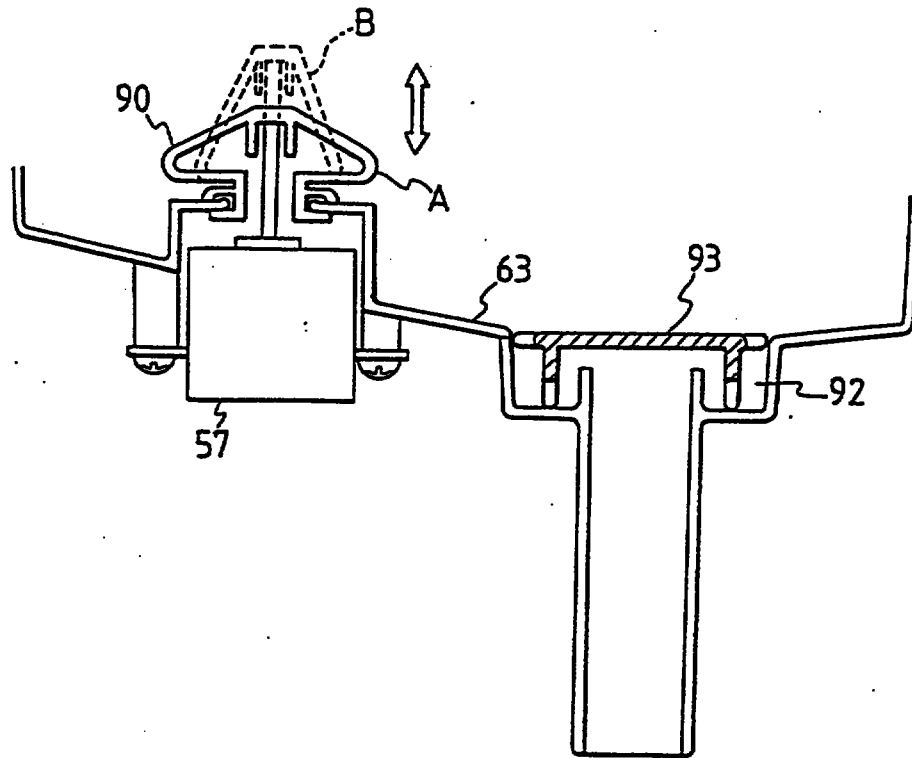


FIG. 10B

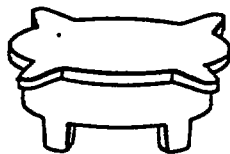
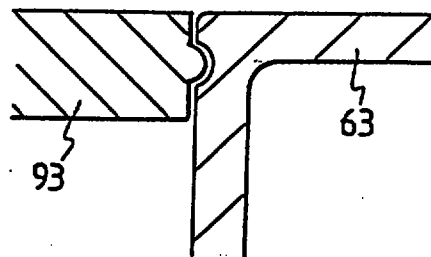


FIG. 10C



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FIG. 11A

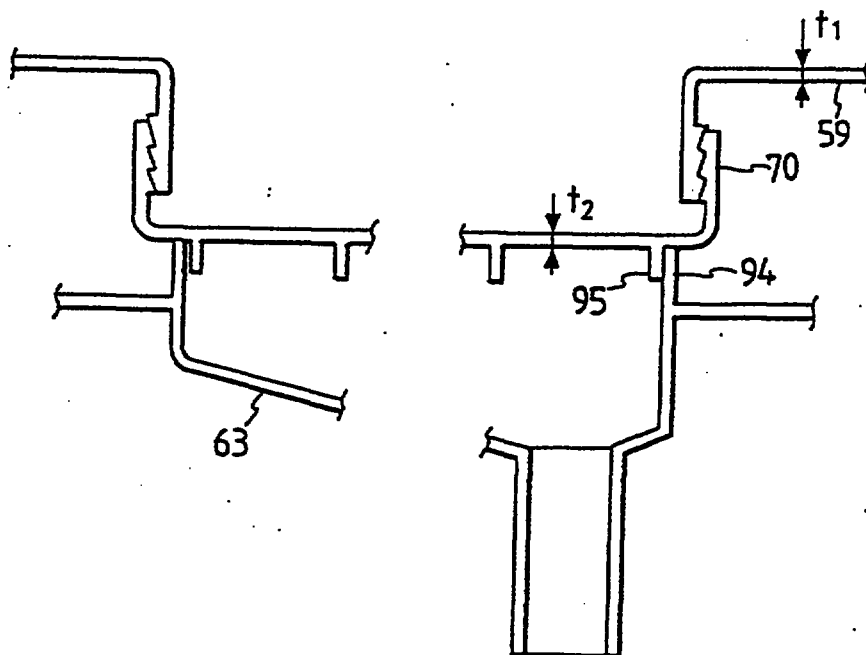


FIG. 11B

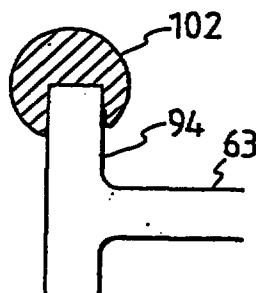


FIG. 12

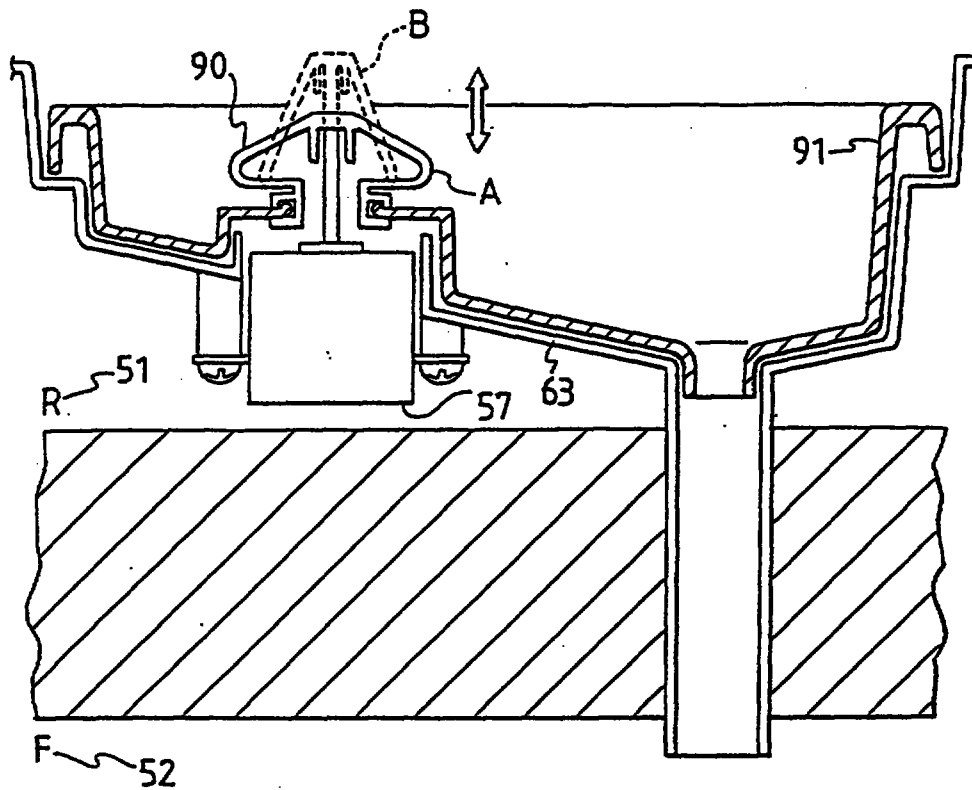
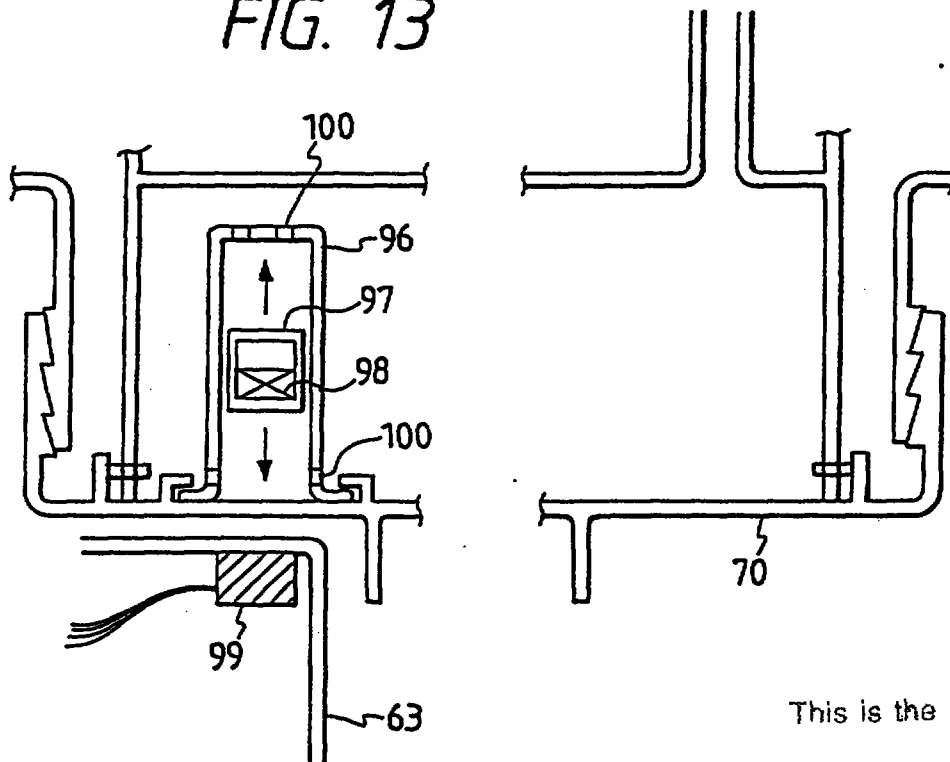


FIG. 13



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FIG. 14

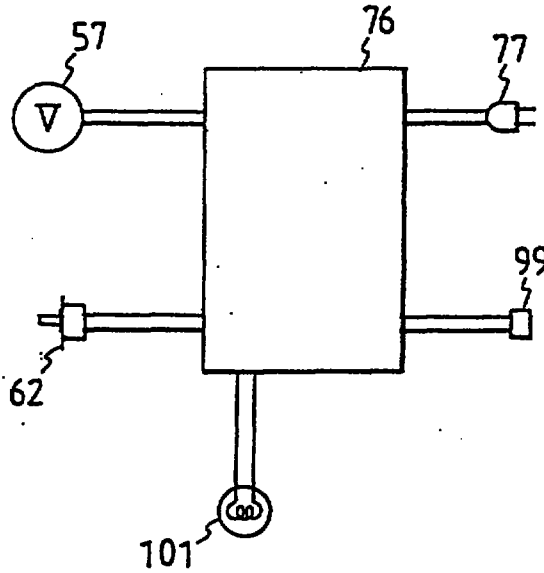
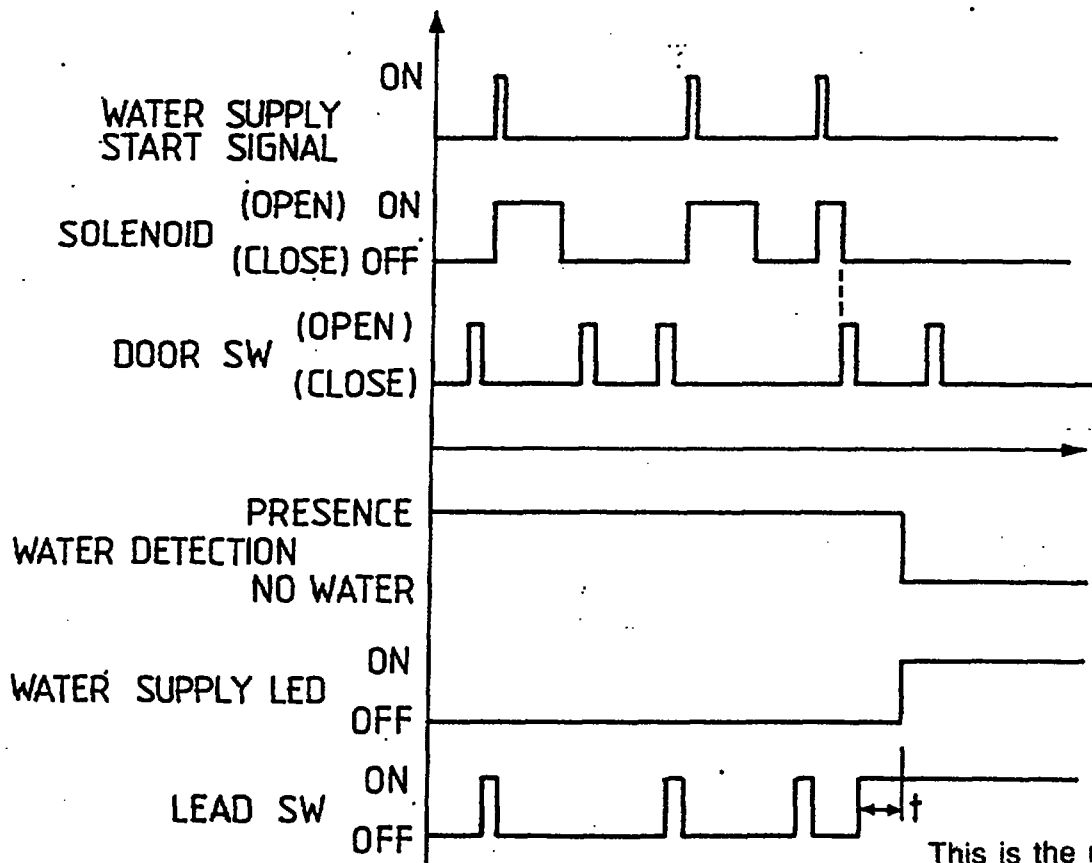


FIG. 15



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FIG. 16A

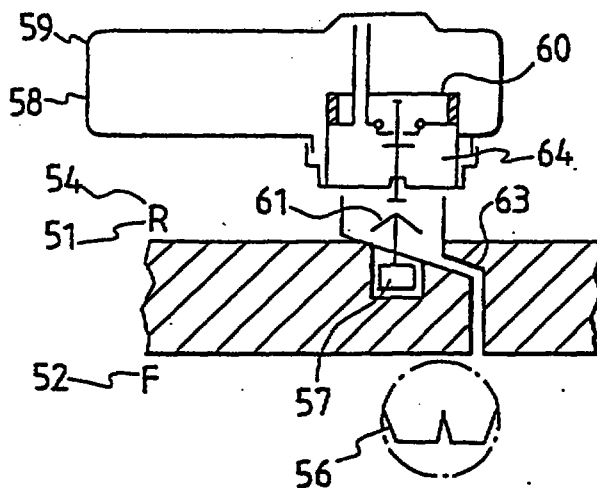
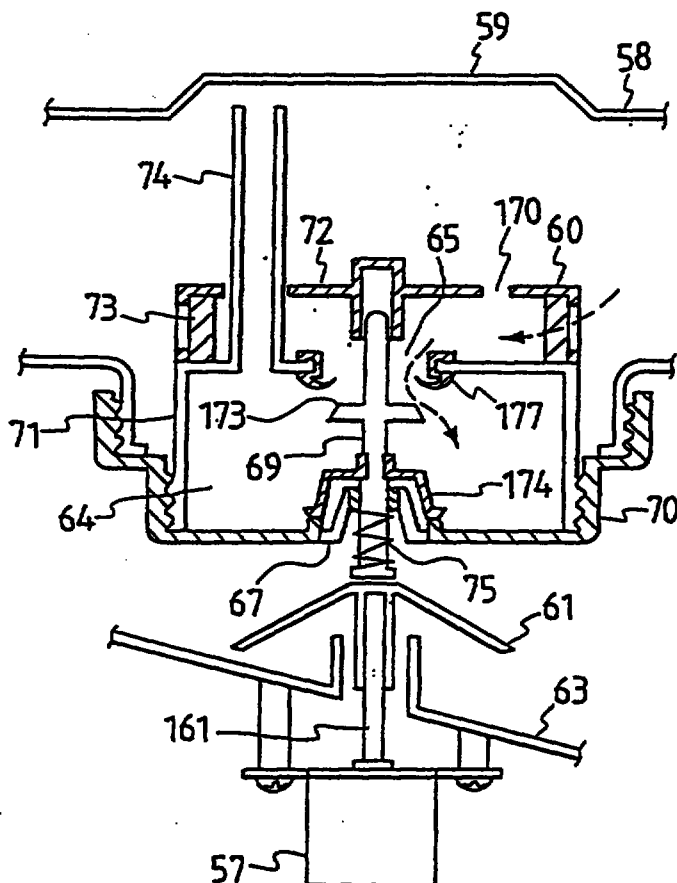


FIG. 16B



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FIG. 17

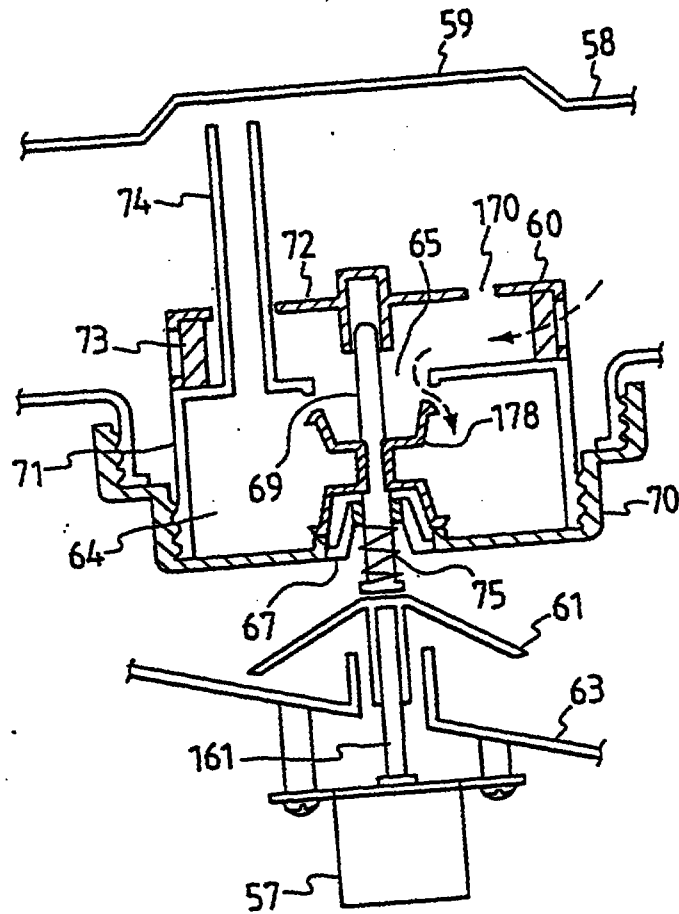
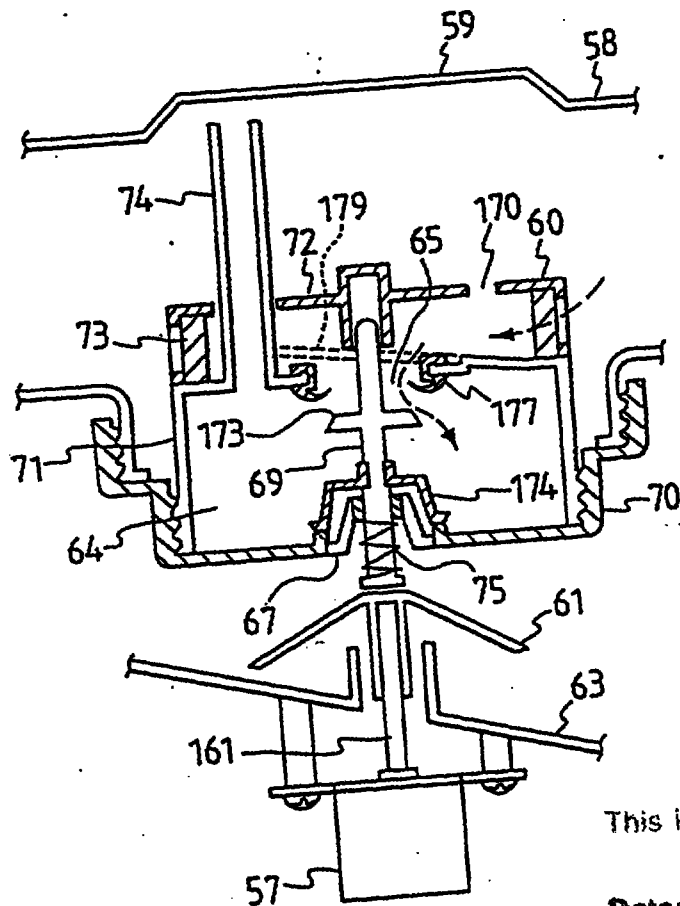


FIG. 18



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FIG. 19

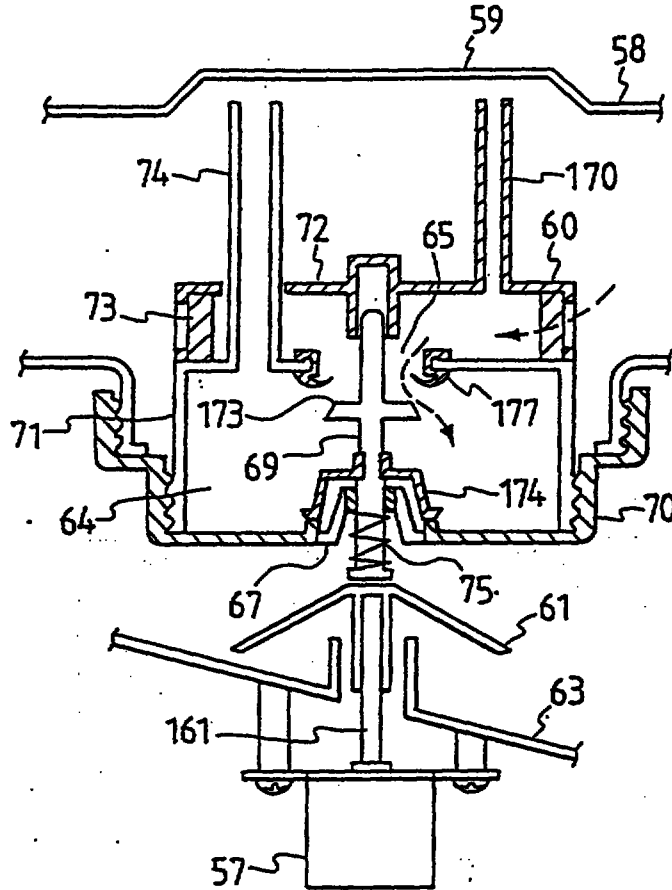


FIG. 20

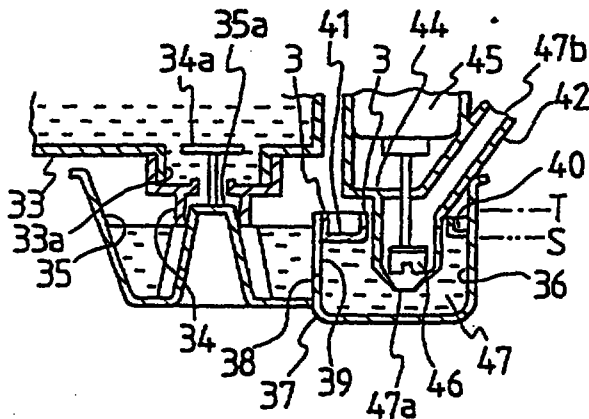
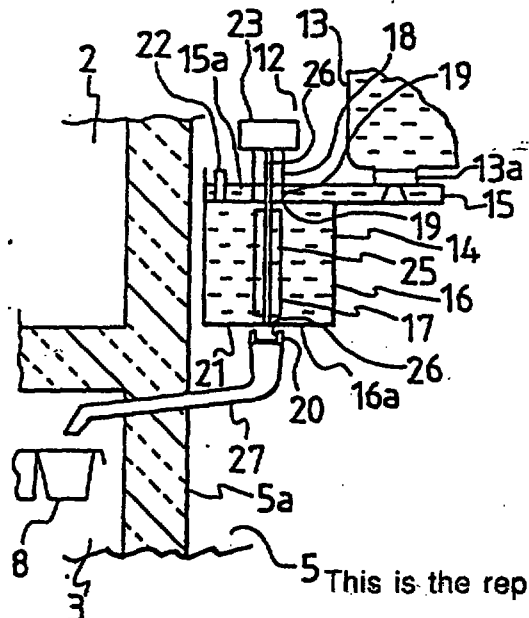
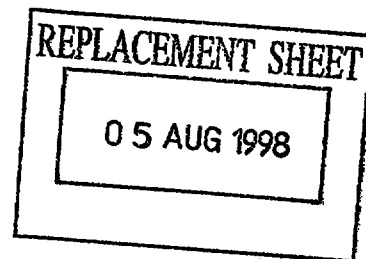


FIG. 21



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REPLACEMENT SHEET

ABSTRACT

WATER SUPPLYING APPARATUS FOR AN AUTOMATIC ICE MACHINE

A water supplying apparatus for an automatic ice machine disposed in an ice making compartment 52 supplies water to an ice making tray 56 in the ice making compartment 52. The water supply apparatus comprises a water tank 59 disposed in an accommodating chamber different from the ice making compartment 52 and located above the latter with a measuring unit 60 incorporated therein. The measuring unit 60 includes a valve assembly comprising an inflow valve 66 and an outflow valve 68 arranged to close an outflow hole 67 at a time when water flows in and close the inflow valve 66 at a time when water flows out; and driving means 57 disposed below the water tank 59 to drive the valve assembly in order to open the outflow valve 68 and close the inflow valve 66 when the water stored in a measuring chamber of the measuring mechanism is supplied to the ice making tray in the ice making compartment. The driving means may include sealing means 61 adapted to come in contact with the valve assembly so as to prevent the driving means from being wetted with water. The water supplying apparatus includes no water receiving section which allows exposure of the water to the environmental air, thereby preventing bacilli from entering the water.

Fig. 2B.