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SPECIFICATION

A Cooling and Purification System for Water in a Water Tank

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Field of the Invention

This invention relates to improvements in a cooling and purification system for water to be used for cooling and purification of water in a water tank.

10 Background of the Invention

The prior art to which the invention is directed includes the art of development of various types of cooling and purification systems for cooling and purifying water contained in a water tank such as one for fish breeding. Among those systems, a cooling and purification system for water comprising possible combinations of a water spraying device, an aeration device, a filtering material and the like is broadly employed for cooling and purifying water in a water tank for fish breeding.

Figure 11 illustrates an embodiment of the system (Patent No. 11-318271) previously developed by the present inventors for cooling and purification of water in a water tank used for fish breeding wherein water W pumped up from the water tank (not illustrated) is dispersed on a filler C by using a water spraying body B, and being forced to be in contact with the air flow A by a fan, thus making water be cooled and purified by means of heat diffusion caused by evaporation and filtration of water through the filler C and also by means of decomposition of organic substances contained in water with help of aerobic microorganisms attached to the filler C.

The cooling and purification system for water as shown in Figure 11 is capable to maintain a temperature of water in the neighborhood of the set values even in summer time requiring lesser energy, and also to keep cleanness of water for a long period of time. This invention, thus, achieves excellent and practical effects.

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It should be noted, however, that with such a cooling and purification system for water as shown in Figure 11 there remain some difficulties to be cleared such as how to improve water treatment capability per unit volume of the system, how to reduce energy consumption and the noise level and also how to prevent water from splashing outward.

With the cooling and purification system for water as shown in Figure 11, the air flow A flows parallel to water W, thus making cooling effects achieved by the air flow relatively low, and failing to raise dissolved oxygen concentration sufficiently. As the result, oxygen will not be fully supplied to the filler C thus lowering the functions of decomposition and nitrification of organic substances to be caused by aerobic microorganisms.

In the end the accumulation of nitrogen compounds such as amine, ammonia, nitrous acid or the accumulation of sulfurized substances such as hydrogen sulfide and the like and carbon compounds such as methane and the like caused by reduction can be easily mounted in the water tank, resulting in the rise of BOD and/or COD values of water which adversely influences living bodies such as fish and the like also causes the distasteful smell.

To prevent the rise of BOD and COD values, it is required that cooling and purification capacities are improved by making the system larger in size. This will, however, bring about the problems related to the production cost, energy consumption and the like.

If the air flow A is sucked from under a filler C to make it flow in a counter direction against water W, this will allow that humid air A flows toward the inlet side of the fan F, and moisture in the air flow A may damage the motor to make it life relatively short.

Furthermore, a conventional cooling and purification system for water has been structured so that water W collided with a spraying body B drips on the filler C. This results that water W does not drip uniformly on the upper surface of the filler C, making a load of the purification treatment applied on each part of the filler C uneven.

In addition, a conventional cooling and purification system for water has been structured so that water W drips directly from the lower end of the filler C onto the bottom area of the tank D, thus making the speeds of water dripping downward accelerated due to the air flow A. As the result, the noise from drips of water W becomes comparatively large, especially at night when it might not be negligible.

Object of the Invention

It is an object of the present invention to provide a cooling and purification system for water in a water tank to overcome the afore-mentioned difficulties with the conventional system such as those: (1) cooling capability of water is relatively low and a motor used for a fan F is easily damaged, (2) purification capability of water is relatively low, and making the system smaller in size and achieving energy saving are difficult, (3) a load of the purification treatment applied on the filler becomes uneven, and (4) noise caused by the operation of the cooling and purification system for water remains high, and thus to provide a cooling and purification system for water to achieve relatively high cooling and purification capability per unit volume, to make the system smaller in size and realize energy saving and low noise operation in order that efficient cooling and purification of water can be achieved.

Disclosure of the Invention

The present invention claimed in Claim 1 is fundamentally composed of a tank 1 equipped with an air inlet port 9, an exhaust port 10 and an outlet 8 for treated water, a filler 5 made up of honeycomb- or lattice-shaped porous materials installed inside the tank 1, a water dripping guide 4 horizontally installed above the filler 5 to let water W to be treated drip onto the filler 5, a dispersion body 3 with which water A is dispersed on the water dripping guide 4, a filler 7 installed underneath the filler 5 for filtrating dripping water W1 that drops through the filler 5, and an air supply device 6 to make the air flow A flow through the filler 5.

The present invention claimed in Claim 2 is fundamentally composed of a tank 1 equipped with an air inlet port 9, an exhaust port 10 and an outlet 8 for treated water W1, a water splash prevention cover 18 removably attached to the

outside of the exhaust port 10 of the tank, thus water W dispersed outwardly together with the air flow A through the exhaust port 10 is separated from the air flow A to recover it into the tank 1, a filler 5 made up of honeycomb- or lattice-shaped porous materials installed inside the tank 1, a water dripping guide 4 horizontally installed above the filler 5 to let water W to be treated drip onto the filler 5, a dispersion body 3 with which water W is dispersed on the water dripping guide 4, a filler 7 installed underneath the filler 5 for filtrating dropping water W1 that drops through the filler, and an air supply device 6 to make the air flow A flow through the filler 5.

In reference to Claim 3 according to the present invention in Claim 1 or Claim 2, water W to be treated is ejected toward the dispersion body 3 from underneath the dispersion body 3 so that water W is dispersed onto the water dripping guide 4.

In reference to Claim 4 according to the invention in Claim 1 or Claim 2, the flow-through pore of the filler 5 made up of a honeycomb- or lattice-shaped body are arranged in the same direction as that of water dripping, and the air flow A is made to flow upward from the under part of the filler 5 in a counter-direction against water W.

In reference to Claim 5 according to the invention in Claim 1 or Claim 2, it is arranged in such a way that water W to be treated is dispersed radially from above the center part of the water dripping guide 4 formed of a flat-shaped guide plate 4a and a water dripping guide pipe 4b projecting downward, and a cutting inclination angle θ at the lower opening of each water dripping guide pipe 4b is so designed that the closer to the outer periphery the water dripping guide pipe 4b is positioned the smaller it becomes.

Brief Description of the Drawings

Figure 1 is a schematic longitudinal sectional view of a cooling and purification system for water illustrating the first embodiment of the present invention.

Figure 2 is a perspective view of a water splash prevention cover.

Figure 3 is a top view of a water dripping guide.

5 Figure 4 is a cross sectional view taken on line E-E of Figure 3 wherein a cutting inclination angle θ at the open end of the water dripping guide is set at 90° with respect to the axis ϕ displaying the situation and range of water dripping.

10 Figure 5 is an illustration similar to Figure 4 when the θ is set at the angle of 45° .

Figure 6 is an illustration similar to Figure 3 when the θ is set at the angle of 30° .

15 Figure 7 is a schematic longitudinal sectional view of a water tank device employing a cooling and purification system for water according to this invention.

20 Figure 8 is a schematic longitudinal sectional view of a water tank device employing a cooling and purification system for water according to this invention.

Figure 9 is a schematic longitudinal sectional view of a water tank device employing a cooling and purification system for water according to this invention.

25 Figure 10 is a schematic longitudinal sectional view of a water tank device employing a cooling and purification system for water according to this invention.

Figure 11 is a schematic longitudinal sectional view of a conventional purification system for water.

30 Explanation of Reference Characters and Numerals

U designates a cooling and purification system for water, T a water tank device, W water to be treated, Wa dispersing water, Wb dripping water, W1 dropping water, W2 treated water, A an air flow, S a water purification part, P an air passage part, θ a cutting inclination angle, Q a dripping range, WL a water level, 1 a tank, 2 a water guide pipe, 3 a dispersion body, 4 a water dripping

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guide, 4a a guide plate, 4b a water dripping pipe, 5 a filler, 6 and air supply device, 7 a filter, 8 an outlet for treated water, 9 an air inlet port, 10 an exhaust port, 11 a lid body, 12 a partition wall, 13 an air passage port, 14 a filter supporting body, 15 a baffle plate, 16 a motor, 17 a moving vane, 18 a water splash prevention cover, WT a water tank, 19 a filtration device, 19a a filter, 19b a sprinkler, 19c a filter supporting body, 19d filtration device, 20 a fixing bridge, 21 a pump, 22 a coupling hose (coupling pipe), 23 a coupling hose (a coupling pipe), 24 a water passage pipe, 25 an underwater pump, 26 an overflow pipe, 27 a filter, 28 an overflow filtration device, and 29 an air passage.

Best Mode of Carrying Out the Invention

The following embodiments of the present invention are described with reference to the drawing hereunder.

<The First Embodiment>

Figure 1 is a schematic longitudinal sectional view of a cooling and purification system for water illustrating the first embodiment according to the present invention..

Referring to Figure 1, there is shown the system wherein W designates water to be treated, Wa dispersing water, Wb dripping water, W1 dropping water, W2 treated water, A an air flow, S water cooling and purification part, P an air passage part, 1 a water tank, 2 a water guide pipe, 3 a dispersing body, 4 a water dripping guide, 5 a filler, 6 an air supply device, 7 a filter, 8 an outlet for treated water, 9 an air inlet port, 10 an exhaust port, 11 a lid body, 12 a partition wall, 13 an air passage port, 14 a filter supporting body, 15 a baffle plate, 16 a motor, 17 a moving vane, and 18 a removable water splash prevention cover.

The afore-mentioned tank 1 is formed in a square shape using synthetic resin and the like, and the inside is separated into two portions, a water purification part S and an air passage part P, by a partition wall 12. An outlet for treated water 8, an air inlet port 9, an exhaust port 10, a lid body 11 and a baffle plate 15 are mounted on the tank 1. There is formed an air passage port 13 underneath the afore-mentioned partition wall 12.

The afore-mentioned water guide pipe 2 is inserted inwardly from underneath the side part of the tank 1, and raised upwardly at the near-center part toward the upper part of the water purification part S, and the upper end has its opening
5 toward the bottom side of the dispersion body 3.

The afore-mentioned dispersion body 3 positioned in the neighborhood of the reverse side of the lid body 11, and fixed to the side wall of the tank 1 or the lid body 11 is formed in the shape of a reversely-placed plate (or a bowl) which
10 diameter is larger than that of the water guide pipe 2.

The afore-mentioned water dripping guide 4 is fixed in a nearly horizontal position with appropriate intervals underneath the dispersion body 3 and above the upper face of the filler 5, and is formed by installing the upper end of a large
15 number of short water dripping pipes 4b having openings at both upper and lower ends on the flat shaped guide plate 4a.

The afore-mentioned filler 5 constituting a filter unit (or an oxidation treatment unit) is formed in a rectangular-prism-shape by combining and assembling a plural number of rod-shaped bodies with a cross section in the
20 shape of honeycomb (hereinafter called a honeycomb-shaped body) or rod-shaped bodies with a cross section in the shape of lattice (hereinafter called a lattice-shaped body) made up of porous synthetic resin or seramic material. On the said honeycomb- or lattice-shaped body, flow-through pores are formed
25 in the shape of honeycomb, or lattice in the cross sectional face of the longitudinal direction.

The said filler 5 is installed and fixed in the near-center part of a water cooling and purification part S comprising a partition wall 12, side walls of the
30 tank, the afore-mentioned water guide pipe 2 penetrates through the center part.

The lower part of the filler 5 constitutes a space for communication of an air passage port 13, and dropping water W1 flowed down through the flow-through pores of honeycomb-shaped body forming a filler 5 drips through
35 the space from the bottom end of the filler 5.

The afore-mentioned porous honeycomb-shaped wall forming a filler 5 performs the functions as a microorganism keeping body as well as a contact medium material between water W to be treated and the air flow A. From the view point of a so-called microorganism keeping function, it is most suited that
5 the diameter of fine pores of the honeycomb-shaped wall be around 1000um, and more preferably the diameter should be 100um and the continuous penetration type of fine pores are most recommended.

10 In the first embodiment according to the present invention, organic polymers such as polypropylene, polyethylene and the like are employed for the porous honeycomb-shaped body. As explained above, the materials can be replaced by silicic acid compounds such as diatomaceous earth and a sintered body (or ceramic body) such as alumina and the like. Any other materials can be employed as long as they are anti-corrosive against water W and porous.

15 Regarding the materials to be used for the afore-mentioned porous honeycomb-shaped body, porous crystals such as hydrous silicia magnesium and the like, active carbon, natural ores such as zeolite and the like, ion-exchange materials and the like, all of which are adsorptive to organic
20 materials added appropriately to the afore-mentioned synthetic resin or ceramic materials can be used so that absorbed organic materials in water W, ion-exchanged ammonium and the like are efficiently oxidized biochemically under the oxidation environment.

25 On the other hand, from the view point of the contact medium material for the contact between water W to be treated and the air flow A, it is desirable that the porous honeycomb-shaped body which forms a filler has a wider surface area.

30 It should be noted, however, that with regard to the porous honeycomb-shaped body, the optimal values (or optimal shape) of the thickness of a wall, the diameter of a honeycomb pore, or the size of a fine pore of the material and the like totally depend on viscosity and the like of water W to be .

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treated. Therefore, it is hard to determine their optimal values or shapes specifically. However, in general, it is understood that the desirable thickness of the wall and the diameter of the pore of the porous honeycomb-shaped body are around 1mm~3mm (the thickness of the wall) and continuous pore 500 μ m~1000 μ m (the diameter of the fine pore) respectively. Depending on the flow rate of water W to be treated and the air volume of the air flow A, the diameter of the honeycomb-shaped flow-through pore, the thickness of the wall and the size of the fine pore of the material are appropriately decided.

In the first embodiment according to the present invention, a filler 5 is formed of the porous honeycomb-shaped body. However, any other materials can be used for the filler 5 as long as the inlet and exhaust of the air flow A can be conducted smoothly with the materials. For example, it could be a lattice- or fiber-shaped body or any other irregular shaped materials which can be filled in the frame.

The afore-mentioned air supply device 6 comprising a motor 16 and a moving vane 17 forces the air flow A sucked through an air inlet port 9 to flow through an air passage port P, and air passage port 13, a water cooling and purification part S, and a filler 5 to an exhaust port 10, then to the outside of the treatment tank body 1 for discharge.

The main objects of the afore-mentioned filter 7 are to reduce the noise of dropping water W1 and filter substances suspended in dropping water W1, and also re-oxidize dropping water W1. It is installed underneath the filler 5 (that is, underneath the water cooling and purification part S), and fixed between the filter and the bottom face of the tank 1 by the supporting body 14 at a certain interval as prescribed.

The said filter 7 is formed of organic soft materials such as porous urethane sponges, polypropylene and the like or fiber bodies as glass wool, fabric body and the like. In this embodiment according to the present invention, porous urethane sponges and glass fiber bodies are laminated for the filter 7.

The afore-mentioned water splash prevention cover 18 is formed in the shape of a thin square box made of synthetic resin. The said water splash prevention cover 18 is removably attached outwardly to the upper part of three wall sides of the tank 1, and separates water W splashed together with the air flow A toward the outside of the tank 1 through the exhaust port 10, and recover separated water W back to the inside of the tank 1. Separated air A is scattered toward the outside of the tank 1 from the upper side of the water splash prevention cover 18.

Figure 2 is an oblique view of the afore-mentioned water splash prevention cover 18. The wall panel 18c which forms the bottom of the cover 18 is equipped with a supporting piece 18a having a grooved stopper 18b.

By means of fitting the side wall 1a which forms an exhaust port 10 of the tank 1 into the grooved stopper 18b of the supporter 18a, the said water splash prevention cover 18 is removably attached to the exterior of the exhaust port 10 formed on the three sides of the wall of the tank 1 in a state that the exhaust port 10 is covered.

Figure 3 is a top plan view of the afore-mentioned water dripping guide 4. Figures 4 to 6 inclusive illustrate the dripping condition of water W under a state of water dripping naturally, and also shows the changes of the dripping range Q of splash caused with the rupture of dripping water by the air flow A. Figure 4 illustrates a cutting inclination angle Θ at the lower end of the water dripping guide pipe 4b is 90° with respect to the axis $\emptyset$, $\Theta=45^\circ$ and $\Theta=30^\circ$ as illustrated in Figures 5 and 6 respectively.

The afore-mentioned water dripping guide 4 comprises a flat-shaped guide plate 4a and a short water dripping guide pipe 4b and a plural number of water dripping guide pipes 4b are arranged and fixed at a prescribed pitch in a straight line (or a concentric circle).

The lower end opening of the afore-mentioned water dripping guide pipe 4b is formed to have the prescribed cutting inclination angle Θ with respect to an axis $\emptyset$, and it is so prescribed that the closer the dripping guide pipe is

positioned to the afore-mentioned water guide pipe is positioned to the

afore-mentioned water guide pipe 2 (namely, the dispersion body 3), the smaller the afore-mentioned cutting inclination angle Θ becomes.

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Dripping water W_b that drops through the lower end opening of the afore-mentioned water dripping guide pipe 4b in a natural state disperses to some degree by the air flow A flowed toward the exhaust port 10 in the space above the filler 5. However, the nearer it is positioned to the exhaust port 10, the more powerful the splashing force becomes, thus resulting in being dispersed afar outwardly. To clear the problem, the farther the water dripping guide 4b is positioned away from the afore-mentioned water guide pipe 2, the larger the cutting inclination angle Θ of the lower end opening is made, and the center position of the dripping range Q is moved toward inwardly (to the side of the water guide pipe 2) in advance, thus making the distribution of dripping water W_b evenly on the surface of the upper end of the filler 5, and at the same time preventing dripping water W_b from dissipation toward the side of the exhaust port 10.

20 When dripping water W_b drips quantitatively under constant hydraulic pressure and also at a fast speed, dripping water W_b flows downward continuously to the inward direction from the beginning along the lower end opening of the water dripping guide pipe 4b. However, more even distribution of dripping water W_b dripping on the filler 5 can be realized regardless the case of dripping water W_b flowing down continuously to the inward direction or the case of the dripping water W_b dripping quantitatively and under constant hydraulic pressure and also at a fast speed because of outwardly dispersion with the air flow A toward the exhaust port 10.

30 In the event that the flow rate of water W that drips is extremely fast, it will be desirable that water W splashed outside is recovered into the tank 1 by fitting the water splash prevention cover 18, and the lower end of each water dripping guide pipe 4b is shaped like one shown in Figure 4 ($\Theta=0$) or shaped contrary to the inclination angles shown in Figures 5 or 6. It has been found experimentally that when the flow rate of water W dripping is fast, a large amount of dripping

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water Wb drips more evenly onto the upper end of the filler 5 by means of making the lower end opening shape as stated above.

Referring now to Figure 1, there is explained the functions of the water purification system.

As illustrate in Figure 1, water W to be treated that is supplied through a water guide pipe 2 disperse on every side when collided with a dispersion body 3, and dispersed water Wa flows out onto the guide plate 4a of the water guide 4. It is desirable that the filtration treatment of water W was done beforehand through a suitable filler such as an urethane sponge and the like to prevent large-sized foreign matter from being mingled into water.

Water Wa dispersed onto the guide plate 4a and kept and stratified on the surface drops onto the filler 5 from the lower end port through each water dripping guide pipe 4b. As stated above, the lower end opening of each water dripping guide pipe is so established that the closer toward the outside it is positioned, the larger the cutting inclination angle Θ becomes. Therefore, dripping water Wb drips onto the surface of the filler 5 relatively in uniform.

While dripping water Wb dripped onto the upper surface of the filler 5 descends through the inside (namely, the flow-through pore of the honeycomb-shaped body), it drops from the lower end of the filler 5 in the form of dropping water W1 after having been treated with the filtering action depending on the type and shape of the material used for the filler 5, and also with the biological purification action by aerobic microorganism.

Dropping water Wa dropped from the lower end of the afore-mentioned filler 5 drips onto the upper surface of the filter 7, thus resulting in drowning the dripping noise almost perfectly. Dropping water W1 turns to be treated water W2 after having been purified through the filter 7, and flows on the bottom face of the tank 1 toward the outlet 8 for treated water.

When a moving vane raises its rotational speeds to increase the cooling capability, dispersing water Wa is scattered to the outside together with the air

flow A through the exhaust port 10.

Even with the case like this, dispersed water W₁ scattered to the outside is recovered into the tank 1 after being separated from the air flow A by fitting the
5 water splash prevention cover 18 on the outside of the exhaust port.

In addition, it should be noted that the air flow A scattered outwardly at the upper part of the water splash prevention cover 18 contains almost no moisture, thus preventing the motor 16 from being damaged by moisture even when the
10 air flow A scattered toward the said outside is sucked again by the rotation of the moving vane 17.

Furthermore, there is no need that the water splash prevention cover 18 is mounted on the side of the tank 1 on which the afore-mentioned baffle 15
15 functions to separate the air flow A from dispersed water splashed toward the outside.

<The Second Embodiment>

Figure 7 is a longitudinal sectional view of a water tank system T for fish
20 breeding employing a water cooling and purification system U for water according to the present invention. The water cooling and purification system U embodying the invention is mounted on the upper part of the filtration system 19 installed on the upper part of the water tank WT employing a bridge 20 for fixture.

25 Referring to Figure 7, 19a is a filtration material, 19b a sprinkler, 19c a filter support box, 21 a pump, 21a a filter, 22 and 23 connecting hoses respectively, 24 a water passage pipe, and WL a water surface. It is advised that a slide type bridge for fixing is employed for the afore-mentioned bridge 20 for fixing.

30 Referring to Figure 7 illustrating a water tank system T for fish breeding, a microorganism treatment with the filtration material 19a is further activated and the degree of purification of water is heightened in the water cooling and purification system U due to the reason that treated water W₂ with fully dissolved

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oxygen by the purification treatment at the water cooling and purification system U is returned to the filtration system 19.

<The Third Embodiment>

5 A cooling and purification system U according to the present invention formed by the filling the filler 5 made of synthetic-resin-made porous honeycomb-shaped body (the outside diameter of the filler 12cm x 12cm, the height 10cm, the size of the flow-through pore of the honeycomb-shaped body 1cm square and the thickness of the wall of the honeycomb-shaped body 1mm)
10 into the tank 1 with a volume of approximately 60 liters is installed on the afore-mentioned filtration system 19 used for the water tank WT for fish breeding with a volume of approximately 60 liters having a filtration system which height is 60cm. And, sea water in the water tank WT was continuously treated for purification over 10 days using the pump 21 which volume was about 8-10
15 liters/min.

With reference to the said third embodiment, sea water contained in the water tank WT before the operation of the cooling and purification system U was found: water temperature=29°C, PH=7.8 and the oxidation reduction
20 potential=180mv, while sea water contained in the water tank WT was measured after the operation of the cooling and purification system U over 10 days and found water temperature=25°C, PH=8.2 and oxidation reduction potential=236mv.

25 The result of the above text reveals that not only the quality of sea water is improved by supplying oxygen but also sea water tested contains property closer to that of natural sea water. Furthermore, another advantage is that water W is cooled by heat of vaporization during the operation of the cooling and purification system U for water, thus resulting in the raising of dissolved oxygen
30 concentration.

< The Fourth Embodiment>

Figure 8 is a longitudinal sectional view of a water tank system T for fish breeding utilizing a cooling and purification system U for water according to the
35 present invention, wherein a water tank WT for simple fish breeding is combined

with an underwater pump 25 and a cooling and purification system U.

The explanation of the purification treatment for water w is omitted because it is similar to that of Figure 7.

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<The Fifth Embodiment>

Referring to Figure 9, there is shown a cooling and purification system U for water applied to a so-called overflow type water tank T for keeping aquarium and other fishes wherein water is circulated for purifying water W from a pump 21 through a connecting hose (or a connecting pipe) 22, a water tank WT and an overflow pipe 26.

Referring to Figure 9 illustrating a water tank WT for fish breeding, a water level WL in the tank 1 changes with evaporation and the like. The filter 7 positioned above the water level functions better aerobically while with the filter 27 positioned below the water level the aerobic function is lowered.

Referring to Figure 9, there is shown a filter 27 placed at the lower part of the tank 1. The explanation of the purification treatment on water W to be treated is omitted because it is similar to that of Figure 7.

<The Sixth Embodiment>

Referring to Figure 10, there is illustrated a cooling and purification system U for water applied to an overflow-type water tank WT for fish breeding equipped with an overflow filtration system 28, wherein the cooling and purification system U is installed above the overflow filtration system 28.

The explanation of the purification treatment for water W is omitted because it is similar to that of Figure 7.

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There is no need to say that a cooling and purification system U for water according to the invention can be combined with the water tank other than the afore-mentioned Figures 7-10 inclusive. A water tank WT and the like to be combined can be chosen regardless their purposes.

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The function of the filler 5 and the like become more effective by mixing catalyzers such as titanium oxide, silver oxide, platinum oxide with the filler 5 or the filter 7 used with the present invention.

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Furthermore, there is no need to say that arbitrary adjustments are made for the size of the cooling and purification system for water, water volume, air volume by the volume of water to be treated and/or concentration of matter existing in water according to the invention. In case that the higher level of cooling and purification treatment is required, two or more of the cooling and purification system can be connected.

Effects of the Invention

A cooling and purification system U for water according to the present invention is so designed that the air flow A flowed from an air inlet device 6 flows through in the form of the counter flow into the filler 5 comprising the porous honeycomb- or lattice-shaped body through which water W to be treated flows down, thus resulting in the tremendous improvement in cooling capability of water, and also the big increase of the oxygen content in water. As the result, biological capability to purify water W is improved amazingly, a cooling and purification system U can be made smaller in size, the manufacturing costs are lowered, and energy saving becomes possible.

A water splash prevention cover 18, according to this invention, is removably attached to the outside of the exhaust port 10. Therefore, even when the volume of the air flow A is increased by raising the capability of the air inlet device 6, there will be no splash of water toward the outside of the tank 1, thus achieving the higher cooling capability.

A filter 7 is installed underneath the filler 5, according to the invention, and dropping water W1 flows through the filter while dripping onto the filter 7. As the result the noise caused by dropping water W1 is completely removed and treated water W2 is highly purified as well.

In addition, a dripping guide 4 is installed above a filler 5, according to this

invention, and water W drips onto the filler 5 through a dripping guide pipe 4b of the dripping guide 4, allowing water W to disperse evenly onto the upper surface of the filler 5, to eliminate almost all the disfavored causes attributable to the uneven distribution of dripping water.

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A water tank device T, according to this invention, is constituted so that water W in the water tank WT is continuously circulated and purified. Therefore, water in the water tank WT can be kept at the lower temperature, of high purity as well as at highly dissolved oxygen concentration, thus fostering to raise fish, other living creatures and the like, and grow aquatic plants, and reducing the death of living creatures.

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As explained above, the present invention achieves excellent, practical effects.

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Scope of Claim

We claim:

- 5 1. A water cooling and purification system in a water tank characterized by providing with a tank 1 having an air inlet port 9, an exhaust port 10 and an outlet 8 for treated water, a filler 5 comprising a porous-material-made honeycomb- or lattice-shaped body installed in the inside of the tank 1, a water dripping guide 4 installed horizontally above the filler 5 so as to let water W to be treated drip on the filler 5, a water dripping guide 4 horizontally
10 installed above the filler 5 and let water W to be treated drip onto the filler 5, a dispersion body 3 allowing water W to disperse upward the water dripping guide, a filter 7 installed under the filler for filtration of water W1 dripping from the filler t, and an air inlet device 6 to allow the air flow A to flow into the filler 5.
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2. A water cooling and purification system in a water tank characterized by providing with a tank 1 having an air inlet port 9, an exhaust port 10 and an outlet 8 for treated water, a water splash prevention cover 18 removably
20 attached to the outside of the exhaust port 10 of the tank 1 to separate water W scattered outside together with the air flow A through the exhaust port 10 from the air flow, thus recovering water into the tank 1, a filler t comprising porous-material-made honeycomb- or lattice-shaped body installed in the inside of the tank 1, a water dripping guide 4 installed horizontally above the filler 5 so as to let water W to be treated drip on the filler 5, a dispersion body
25 3 allowing water W to disperse upward the water dripping guide 4, a filter 7 installed under the filler for filtration of water W dripping from the filler 5, and an air inlet device 6 to allow the air flow A to flow into the filler.
3. A water cooling and purification system as claimed in Claim 1 or Claim 2
30 wherein water W to be treated is sprayed toward a dispersion body 3 from under the dispersion body 3, to let water W disperse above the water dripping guide 4.
4. A water cooling and purification system as claimed in Claim 1 or Claim 2
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wherein a flow-through pore of the filler 5 comprising a honeycomb- or lattice-shaped body is installed in the same direction as that of the dripping of water W, and allows the air flow A flow against water W from the lower end of the filler 5 toward the upper end.

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5. A water cooling and purification system in the water tank as claimed in Claim 1 or Claim 2 wherein water W is dispersed radially from above the center part of the water dispersing guide 4, which is formed of a guide plate 4a and a flat-shaped water dripping guide b projecting downward, and is ,furthermore, designed so that the cutting inclination angle Θ at the lower ends of the opening of each water dripping guide pipe 4b are made smaller as the water dripping guides 4b reach close to the outer periphery.

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