

FILTER DEVICE FOR AQUARIUM TANK

This invention relates to a filter device which is set on top of an aquarium tank for filtering water circulated from the tank.

The prior art filter devices for an aquarium tank are constructed such that water filtered through a filter bed is returned to the tank body directly from a downflow port provided in the bottom of the filter bed or indirectly through a circulation duct connected to the downflow port.

Meanwhile, the pumping capacity of a water pump varies with the voltage and frequency of the power source and also with the water level in the tank. When the pumping capacity of the water pump is exceeded, i.e., when the amount of water entering the filter bed exceeds the amount of water returning into the tank from the filter bed, water overflows. To avoid this, in the prior art filter device the inner diameters of the downflow port and circulation duct are set greater than that of the suction duct of the water pump.

This means that filtered water flows through the downflow port and circulation duct at a rate lower than the intrinsic downflow capacity.

However, when the filtered water flows through the downflow port and circulation duct at a rate lower than the downflow capacity, it flows down while absorbing air present in the downflow port and circulation duct at

all times, thus producing the sound of falling water. Therefore, when the filter device is operated in a quiet room, the water sounds noisy. Particularly, at night it may disturb anyone sleeping nearby.

An attempt has been made to suppress the generation of such noise by charging coarse cotton in the downflow port. In this case, however, the cotton picks up dirt and clogging results.

Installation of a pipe in the downflow port has also been tried. In this case, however, changes in the water flow rate cannot be coped with owing to the reduction of the outflow area, and it is impossible to suppress the generation of noise due to the trapping of air.

An object of the invention is to provide a filter device for an aquarium tank, which can markedly reduce noise generated when filtered water from it flows down into the tank body.

According to the invention, there is provided a filter device for an aquarium tank, which comprises a filter bed disposed above a tank body and filled with a filter material for filtering water pumped up from the tank body by a water pump, the filtered water being circulated through a circulation duct back into the tank body, the filter device being characterised in that a filter chamber filled with a filter material is formed, that a float chamber is formed in communication with the filter chamber and has the bottom thereof provided with a downflow port having a lower open end communicating with the circulation duct and an upper open end, and that a float is provided for vertical movement in the float chamber with the underside thereof capable of making contact with the upper open end of the downflow port.

According to the invention, a vertically movable float is provided at an open end of the downflow port and,

according to the amount of filtered water supplied, the float is moved vertically to control the amount of water flowing through the downflow port. Thus, noise generated as the filtered water flows down into the tank body can be markedly reduced.

The above and other objects and features of the invention will become more apparent from the following description when the same is read with reference to the accompanying drawings, in which:

Figure 1 is an elevational view showing an aquarium tank provided with a filter device;

Figure 2 is a plan view, partly broken away, showing the filter device;

Figure 3 is an elevational sectional view showing a float chamber of a filter device according to the invention;

Figure 4 is a side sectional view showing the float chamber shown in Figure 3;

Figure 5 is a plan view showing the float chamber shown in Figure 3;

Figure 6 is a sectional view showing the float chamber with the float ascending; and

Figure 7 is a perspective view showing a downflow port formed in the bottom of the float chamber.

Referring to the figures, there is shown a filter device generally designated at 1. The device 1 comprises a base frame 4 which is set on a top frame 3 of a tank body 2. A filter bed 5 and a water pump 6 are provided on the base frame 4. The filter bed 5 has a filter chamber 7 and a float chamber 8. Water in the tank is pumped up by the water pump 6 and supplied to a filter material 9 in the filter chamber 7 for filtering, and the filtered water is caused to flow through the float chamber 8 and a circulation duct 10 back to the tank.

In the filter chamber 7, a slatted drainboard 11

is laid at a position spaced apart from the bottom. The filter material 9 is charged on the slatted drainboard 11. Above the filter material 9, a distribution trough 12 is disposed so as to extend in the longitudinal direction of the filter chamber 7. Water discharged from a discharge nozzle 13 of the water pump 6 is caused to flow uniformly into the distribution trough 12 and thence flow down uniformly through a number of distribution holes 14 formed in the bottom of the trough 12 onto the filter material 9 over the entire area thereof. Water that has been filtered through the filter material 9 flows along a flow path 15 between the slatted drainboard 11 and the trough bottom into the float chamber 8.

The float chamber 8 is formed on one side of the filter bed 5. As shown in Figure 3, the float chamber 8 has its bottom provided with an upwardly extending short cylindrical downflow port 16 and its side adjoining the filter chamber formed with a plurality of vertical rib-like guides 18 for guiding a float 17, these guides 18 being communicated with the flow path 15 under the slatted drainboard 11 via a hole 19 at the bottom of the float chamber 8. The size of the downflow port 16 is set taking the pumping capacity of the water pump 6 into consideration such that water can flow down even when the amount of water discharged from the water pump is maximum.

The circulation duct 10 is fitted in the open lower end of the downflow port 16 and has its lower end provided with a nozzle 20 from which water flows out laterally. The nozzle 20 is located at a position lower than the water level in the tank body 2. In other words, in use of the aquarium tank, water is charged into the tank body 2 until the nozzle 20 is immersed in water.

The float 17 provided in the float chamber 8 is a sealed box-like body with a knob portion 17' provided at the top. Its size and shape are such that the float can

be freely vertically moved in the float chamber 8 as it is guided along the guides 18 and side walls of the chamber. Its bottom has a larger area than the open end of the downflow port 16 so that the float can close the open end. Further, it has a construction such that the buoyancy is greater than the suction force produced by water in the circulation duct 10.

In the filter device 1 having the above construction, by operating the water pump 6 water is discharged from the discharge nozzle 13 and supplied through the distribution holes 14 in the distribution trough 12 onto the filter material 9 in the filter chamber 7. The water thus supplied is filtered as it passes through the filter material 9. The filtered water passes through the slatted drainboard 11 and flows along the flow path 15 into the float chamber 8.

As the filtered water flows into the float chamber 8, the water level therein increases. When the water level becomes higher than the open end of the downflow port 16, the lower portion of the float 17 is immersed in water, thus generating buoyancy. The buoyancy increases with progressive increase of the water level. When the buoyancy becomes equal to the weight of the float 17, the float 17 ascends, thus producing a gap 21 between the underside of the float 17 and the open end of the downflow port 16, as shown in Figure 6. Thus, the filtered water subsequently flows from the flow path 15 into the float chamber 8 and then through the gap 21 into the downflow port 16, and thereafter passes through the circulation duct 10 and nozzle 20 back to the tank body 2.

In this case, with further increase of the amount of the filtered water flowing from the flow path 15 into the float chamber 8, the water level therein further increases, thus causing the float 17 to rise and enlarge the gap 21. Thus, the amount of the filtered water

flowing from the float chamber 8 into the downflow port 16 increases, and eventually the amount of the filtered water flowing from the flow path 15 into the float chamber 8 and the amount of the filtered water flowing from the float chamber 8 into the downflow port 16 become equal. When this state is established, the filtered water flows from the downflow port 16 into the circulation duct 10 at the maximum possible rate. At this time, the float 17 is found just above the downflow port 16, and no air is trapped by the filtered water circulated from the float chamber 8 to the tank body 2. Thus, no water sound stemming from trapped air is generated.

Meanwhile, when hydrophytes are caught at the water inlet 22 of the water pump 6 or when the supply voltage is reduced, for example, the amount of water supplied to the filter bed 5 is reduced. In this case, the amount of water passing through the filter material 9 is also reduced to reduce the amount of filtered water flowing into the float chamber 8.

In this way, with reduction of the amount of filtered water flowing into the float chamber 8, the water level therein decreases to lower the float 17 so as to reduce the gap 21 between the underside of the float 17 and the open end of the downflow port 16. Thus, again in this case the amount of the filtered water flowing from the filter chamber 7 into the float chamber 8 and the amount of the filtered water from the float chamber 8 into the downflow port 16 eventually becomes equal, thus avoiding the trapping of air in the filtered water circulated from the float chamber 8 into the tank body 2.

When the amount of water supplied from the water pump 6 is reduced and eventually becomes zero, the water level in the float chamber 8 decreases to lower the float 17 and eventually the underside of the float comes into contact with the open end of the downflow port 16 to close

the downflow port 16.

When the downflow port 16 is thus closed by the float 17 in this way, filtered water is no longer circulated, and water remains in the circulation duct 10, sucking the float 17 onto the downflow port 16.

When the pumping capacity of the water pump 6 is restored by removing extraneous matter at the water inlet 22, for instance, the amount of water supplied to the filter chamber 7 increases to raise the water level in the float chamber 8. Since the float 17 is set so as to generate higher buoyancy than the suction produced by the water in the circulation duct 10, with an increase of the water level to a certain extent with respect to the downflow port 16, the float 17 ascends against the suction force.

As a result, the downflow port 16 which has been closed by the float 17 is opened, and the filtered water in the float chamber 8 flows through the gap 21 formed between the float 17 and the downflow port 16 into the downflow port 16. Thereafter, the float 17 is moved vertically to control the gap 21 in accordance with the amount of the filtered water flowing from the filter chamber 7 into the float chamber 8. Thus, the filtered water can be quietly returned to the tank body in the manner as described above.

In this embodiment, as shown in Figures 4 and 5, an overflow path 23 is formed aside the float chamber 8 and, in the event that the float 17 fails to rise due to a malfunction, the filtered water is caused to overflow through the overflow path 23 into the tank body 2.

Further, in this embodiment the entire circumference of the open end of the downflow port 16 is closed by the underside of the float 17. Thus, when the underside of the float 17 approaches the downflow port 16, i.e. when the gap 21 is reduced, the float 17 is sucked

onto the downflow port 16 by the force of the filtered water flowing down from the downflow port 16. Accordingly, as shown in Figures 6 and 7, the downflow port 16 may be formed with notches 24 for reducing the suction acting on the float 17.

As has been described in the foregoing, according to the invention the amount of water supplied from the water pump and the amount of water returned to the tank can be controlled by the vertical movement of the float just above the downflow port. In addition, it is possible to eliminate the suction of air through the downflow port and fill the circulation duct with water from the downflow port. Thus, it is possible to markedly reduce the sound of falling water generated when the filtered water flows down from the filter device into the tank body. Thus, the filter device may be operated in a quiet room without generation of any undesired noise, and also it may be operated without disturbing those sleeping nearby.



Claims:

1. A filter device for an aquarium tank, comprising a filter bed disposed above a tank body and filled with a filter material for filtering water pumped up from said tank body by a water pump, the filtered water being circulated through a circulation duct back into said tank body, said filter device being characterised in that a filter chamber filled with a filter material is formed, that a float chamber is formed in communication with said filter chamber and has the bottom thereof provided with a downflow port having a lower open end communicating with said circulation duct and an upper open end, and that a float is provided for vertical movement in said float chamber with the underside thereof capable of making contact with the upper open end of said downflow port.

2. The filter device according to claim 1, wherein the upper open end of said downflow port has at least one notch.

3. A filter device for an aquarium tank substantially as hereinbefore described with reference to and as shown in the accompanying drawings.