

AQUARIUM TANK

This invention relates to an aquarium tank for keeping freshwater or tropical sea fish as aquarium fish.

Japanese Utility Model Publications No. 44-9505 and No. 44-9506 disclose aquarium tanks for keeping fish.

In the disclosed tanks, a filter, a thermostat, a heater, etc. necessary for keeping fish are disposed in the tank, and wiring and tubing are accommodated in a tank support. However, the support and tank cannot be separated from each other, which is very inconvenient when changing the water in the tank and cleaning the inside of the tank.

On the other hand, in the water within an aquarium tank in which fish are being kept, there exist suspended macro-matter including excrement of the fish and bait residue and suspended micro-matter including ammonia and organic nitrides contained in the excrement. For this reason, the tank is required to have a filter for filtering the water in the tank. However, since the conventional tanks are provided therein with a single filter, it is difficult for the filter to completely remove not only the suspended macro-matter but also the suspended micro-matter and, therefore, long-time use of the single filter in the tank will result in the accumulation in the tank of ammonia and organic nitrides which may possibly kill the fish being kept.

With the conventional filters, therefore, it is difficult to stably purify the water in the tank over a long period of time. Such insufficient purification of the water in the tank results merely in a slight
5 reduction of the number of times the water has to be changed.

Therefore, there has been desired a tank provided with a filter that is capable of ensuring a suitable water
10 habitat, is readily removably accommodated in the tank along with various components such as a thermostat, a heater and a pump, can be easily separated from a tank support, and is convenient when changing the water in the tank and cleaning the inside of the tank.

15 The present invention has been achieved in the light of the above problems, and one of its objects is to provide an aquarium tank capable of stably purifying the water therein over a long period of time and
20 creating a suitable water habitat.

Another object of the present invention is to provide an aquarium tank capable of readily removably accommodating various components such as a filter, a

thermostat, a heater and a pump therein at positions invisible from the outside.

To attain the objects described above, according to
5 the present invention there is provided an aquarium tank comprising:

a tank body including an outer frame open at the front, sides and top, a transparent body mounted in said outer frame so as to close watertightly the open
10 front and sides and three separately disposed filter members;

a tank filter incorporating the first and third filter elements and removably mounted in the watertightly closed tank body and including a vertical
15 plate and a plurality of partitioning members provided on the rear surface of said vertical plate;

a bottom filter incorporating the second filter element and removably mounted in said tank body and having an upright wall formed at the rear edge
20 thereof;

a pump and a heater mounted in said tank filter;
and

a lid incorporating an illumination unit, and electrical wiring connecting the illumination unit,

the pump and the heater to a power source;

the first filter member being arranged for physical filtration and the third filter member containing activated carbon for absorbing micro-matter each being removably mounted in said tank filter;

the second filter member incorporating living bacteria and being disposed on the upper surface of said bottom filter for biological filtration, and

flow through the filter elements being arranged to cause micro-matter such as fish excrement and bait residue to be filtered off in the first filter member, ammonia and organic nitrides to be deprived of noxiousness by bacteria at the second filter member and suspended micro-matter to then be removed in the third filter member, whereby enabling substantially clear water to be supplied to visible parts of the tank.

With the aquarium tank according to the present invention provided in the tank body with the first filter member for physical filtration, the second filter member for biological filtration and the third filter member containing activated carbon for adsorbing suspended micro-matter thereon, suspended macro-matter such as fish excrement and bait residue in the water is filtered off by the first filter member, ammonia and organic nitrides resulting from the excrement are deprived of noxiousness by bacteria attached to the second filter member, and part of the water treated with the first and second filter members and containing the organic substances free from noxiousness and suspended micro-matter is transmitted to the third filter member to adsorb the suspended matter on the activated carbon contained in the third filter member, whereby clear water almost completely deprived of the impurities can be supplied into the visible part of the tank at all times. Thus, the three filter members can purify the water independently of each other to enhance their respective filtration effects and carry out stable filtration over a long period of time.

The three filter members can be easily mounted in and detached from the tank along with the heater and pump and, therefore, change of the filter and inspection of the pump and heater can be effected with ease. Since the components and filter are disposed behind the vertical plate within the tank, only swimming fish and ornamental articles can be seen from the front and sides of the tank through the transparent body, thus bringing about an aesthetic effect.

The above and other objects, features and advantages of the invention will become apparent from the following detailed description made with reference to the accompanying drawings, in which:

Figure 1 is a perspective view, from the oblique rear, showing one embodiment of the aquarium tank according to the

invention;

Figure 2 is an exploded perspective view of the tank shown in Figure 1;

Figure 3 is a transverse sectional view of the tank shown in FIG. 1;

Figure 4 is a sectional view taken along line IV-IV in Figure 3;

Figure 5 is a partially cutaway sectional view taken along line V-V in Figure 3;

Figure 6 is a longitudinal sectional view showing the tank with a tank filter held raised from the tank;

Figure 7 is an exploded perspective view showing the tank filter of Figure 6;

Figure 8 is a longitudinal sectional view showing another example of the tank filter mounted in the aquarium tank according to the invention;

Figure 9 is an exploded perspective view showing the tank filter of Figure 8;

Figure 10 is a partially cutaway side view showing another embodiment of the aquarium tank according to the invention; and

Figure 11 is a perspective view showing a bottom filter and a tank filter mounted in the tank of Figure 10.

Figures 1 to 7 illustrate one embodiment of the aquarium tank according to the present invention, which is indicated by reference numeral 1. In the aquarium tank 1, a detachable tank filter 5 provided with a first filter member 2a, a third filter member 2c, a pump 3 and a heater 4 with a thermostat, and a bottom filter 6 having a second filter member 2b disposed on the surface thereof are removably accommodated in a tank body 7.

As-shown in Figures 1 to 3, the tank body 7 of the aquarium tank 1 according to the invention has an outer frame 8 made of synthetic resin or the like and is open on the front, portions

of the opposite sides and top. A transparent body 9 made of glass, transparent synthetic resin or the like and having a U-shaped sectional profile is mounted in the outer frame using a silicone-based adhesive so that the open front and side portions of the outer frame 8 are closed watertightly. An illumination unit 10 is disposed at the top of the outer frame 8. A lid member 11 with a hinged portion for opening and closing a front portion of the top of the outer frame 8 is removably provided on the top of the outer frame 8. The transparent body 9 may be a U-shaped one-piece molding of glass or transparent synthetic resin, or may be formed by bonding three transparent plates along edges thereof to one another into a U-shaped form with or without thin bars or poles along the bonded edges. Otherwise, transparent plates may be applied to the inner surfaces of the front and opposite side walls of the outer frame 8, with their upper and lower edges closed watertightly with adhesive.

The inner bottom surface of the tank body 7 is formed with two parallel transversal ridges 12 which constitute a stopper section 13 (Figures 4 to 6).

The detachable tank filter 5 accommodated in the tank body 7 has a vertical plate 14 and opposite end partitioning members 15 provided along the opposite edges of the rear surface of the vertical plate 14. A transverse partitioning member 15a is provided such that it extends between the two partitioning members 15 at a lower position thereof, thus defining a heater chamber 16 below it. Above the transverse partitioning member 15a, a pair of vertical partitioning members 15b and 15c are provided at a prescribed interval to divide a space above the transverse partitioning member 15a into three side-by-side divisions, i.e. first and third filter sections 17 and 18 and a pump chamber 19, each being open on the rear.

In the heater chamber 16, a pair of opposite side receiving sections 21 are formed, which receive opposite side rubber

portions 20 of the heater 4. The vertical plate 14 has its lower portion formed with a plurality of first slit-like water passage holes 22a which communicate the outside of the vertical plate 14 with the heater chamber 16. The transverse partitioning member 15a is formed at a portion thereof above which the first filter section 17 is defined with second slit-like water passage holes 22b so as to communicate the heater chamber 16 with the first filter section 17 and at a portion thereof above which the third filter section 18 is defined with third slit-like water passage holes 22c so as to communicate the heater chamber 16 with the third filter section 18. The transverse partitioning member 15a is further formed at a portion thereof above which the pump chamber 19 is defined with a hole 23 so that a water inlet of the pump 3 mounted in the pump chamber 19 faces the heater chamber 16 via the hole 23. The transverse partitioning member 15a is further formed at a portion thereof above which the pump chamber 19 is defined with a notch 25 in which the cord 24 of the heater 4 is received (Figures 3 and 5).

The heater 4 with thermostat is removably mounted by the opposite end rubber sections 20 received by the opposite side receiving sections 21 in the heater chamber 16 so that its heat generating section 26 will not be in contact with the synthetic resin outer frame 8 or partitioning members 15 to avoid otherwise possible thermal deformation of the outer frame and partitioning members. The cord 24 of the heater 4 is led upwardly from the pump chamber 19 through the notch 25 of the transverse partitioning member 15a and also through a guide 27 provided on an upper end portion of the back surface of the outer frame 8 of the tank body 7 to be connected to a current collector section 28 provided on the back of the lid 11.

A portion of the vertical plate 14 defining the first filter section 17 is formed with a plurality of fourth water passage holes 22d which communicate the outer surface side of the vertical plate 14, i.e. the fish swimming portion, with the

first filter section 17. The vertical partitioning member 15c is formed with an upper end notch 30 through which a branched discharge tube 29 of the pump 3 is supported and led into the third filter section 18. A portion of the vertical plate 14 defining the pump chamber 19 is formed with an upper end notch 32 through which a discharge tube 31 of the pump 3 is supported and led to the outer surface side of the vertical plate 14 for pouring water into the fish swimming portion.

The first and third filter sections 17 and 18 are filled with the first filter member 2a consisting of chemical fiber and the third filter member 2c containing activated carbon, respectively. The pump 3 disposed in the pump chamber 19 has its discharge tube 31 supported on and extending upwardly from the pump and then horizontally through the upper end notch 32 to the upper portion of the fish swimming portion on the outer surface side of the vertical plate 14, and the branched discharge tube 29 branching from the discharge tube 31 at an upper position thereof is supported on and led through the upper end notch 30 into the third filter section 18. The cord of the pump 3, like the cord 24 of the heater 4, is led through the guide 27 to be connected to the current collector section 28 which is in turn connected to an external power source.

The current collector section 28 is also connected to the illumination unit 10 of the lid 11. Power is thus supplied to the illumination unit 10, pump 3 and heater 4.

The detachable tank filter 5 carrying the first filter member 2a, third filter member 2c, heater 4 with thermostat and pump 3 can be accommodated and mounted in the tank body 7 with the lower edge of the vertical plate 14 received in the stopper section 13 on the bottom surface of the outer frame 8 so that it is restricted against back-and-forth movement. It is also restricted against transverse movement by fitting the free ends of its vertical partitioning members 15b and 15c in stopper sections 33 formed on the inner surface of the back

wall of the outer frame 8 and each comprising two parallel ridges like the stopper section 13.

The bottom filter 6 removably accommodated in the tank body 7 has a transversal plate 35 formed with a plurality of slit-like small holes 34, a plurality of legs 36 depending from the lower surface of the transversal plate 35 and an upright wall 37 extending upright from the rear edge of the transversal plate 35 so as to be in face-to-face contact with the vertical plate 14 of the tank filter 5.

The second filter member 2b comprising gravel and/or glass balls which are greater in size than the width of the slit-like small holes 34 and to which living bacteria are attached for decomposing ammonia and organic nitrides contained in fish excrement, is placed on the bottom filter 6 with the aim of improving the aesthetic effect in constituting a second filter section 38. If the second filter member 2b is placed to a level lower than the upper end of the upright wall 37, it will not fall onto the bottom of the aquarium tank 1 when mounting or dismounting the tank filter 5 relative to the tank body 7.

For the use of the aquarium tank 1 having the construction described above according to the invention, first the detachable tank filter 5 is assembled by installing the pump 3 in the pump chamber 19, leading the discharge tube 31 through the notch 32 to the outer surface of the vertical plate 14, filling the first filter section 17 with the first filter member 2a and the third filter section 18 with the third filter member 2c and mounting the heater 4 with thermostat in the heater chamber 16. The detachable tank filter 5 thus assembled is then accommodated in a rear portion of the interior of the tank body 7. Then, the bottom filter 6 is set on the inner bottom surface of the tank body 7, and the second filter member 2b is put on the bottom filter 6 to form the second filter section 38. Thereafter, the tank body 7 is filled with water, and then the heater 4 and the pump 3 are operated. As a result, water heated

to a prescribed temperature in the heater chamber 16 of the detachable tank filter 5 is supplied through the discharge tube 31 of the pump 3 into the fish swimming portion and part of the heated water is supplied through the branched discharge tube 29 of the pump 3 into the third filter section 18.

On the other hand, with the operation of the pump 3 water in the heater chamber 16 is withdrawn from a suction port 3a of the pump 3 to produce a reduced pressure state in the heater chamber 16. However, water in the fish swimming portion flows into the heater chamber 16 from the second filter section 38 through the first water passage holes 22a formed in the lower portion of the vertical plate 14, from the first filter section 17 through the second water passage holes 22b and from the third filter section 18 through the third water passage holes 22c.

Thus, the flow of water in the tank body 7 pursues three courses. To be specific, water flows through the fourth water passage holes 22d, first filter section 17 and second water passage holes 22b into the heater chamber 16 in the first course, through the first water passage holes 22a into the heater chamber 16 in the second course, and through the third filter section 18 and third water passage holes 22c into the heater chamber 16 in the third course. Water in the heater chamber 16 is thus supplied by the pump 3 through the discharge tube 31 into the tank body 7 to form a re-circulation stream, and also is partly supplied through the branched discharge tube 29 into the third filter section 18 to form a re-circulation stream.

To be specific, in the re-circulation streams, the water in the fish swimming portion of the tank body 7 flows through the fourth water passage holes 22d into the first filter section where the suspended macro-matter including fish excrement and bait residue is filtered off and the filtered water flows down into the heater chamber 16 through the second water passage holes 22b (in the first course), while it flows through the second filter section 38 (the second filter member 2b) to filter

off the suspended micro-matter and to cause noxious ammonia and organic nitrides to be decomposed by the bacteria into substances free from noxiousness and then flows through the small holes 34 into the lower portion of the bottom filter 16 and then through the first water passage holes 22a into the heater chamber 16 (in the second course). Thus, the water in the tank is subjected to physical filtration via the first filter member 2a and biological filtration via the second filter member 2b and then flows into the heater chamber 16.

On the other hand, the water discharged out of the branched discharge tube 29 of the pump 3 passes through the third filter member 2c in the third filter section 18 to cause the micro-substances including the organic nitrides and decomposed substances to adsorb on the activated carbon, and the purified water flows through the third water passage holes 22c into the heater chamber 16 (in the third course).

Thus, there is formed a main water circulation path for supplying the water thus purified in the first, second and third courses and stored within the heater chamber 16 into the pump 3 of the pump chamber 19 and then into the fish swimming portion through the discharge tube 31, and returning the water into the pump 3 through the first or second course and there is also formed a sub-water circulation path for supplying the water into the third filter section 18 through the branched discharge tube 29 and returning the water to the pump 3 through the third course. The amount of the water supplied from the branched discharge tube 29 of the pump 3 into the third filter section 18 is determined by the amount of water in the tank, the rate of water to be discharged by the pump 3 and the amount of the filter members, and is preferably 20 to 30% the total amount of water discharged by the pump 3 where the volume of the tank is $17\frac{1}{2}$ and the rate of water discharged by the pump 3 is $3\frac{1}{2}$ /min. By returning not all the water treated with the first and second filter members to the fish swimming portion and filtering part

of the water with the third filter member, purification of the water in the tank can be enhanced and degradation of the filtering capability of each filter member can be suppressed.

As described above, in the aquarium tank 1 of the present invention, the physical filtration and biological filtration are carried out by the first and second filter members 2a and 2b in the main water circulation path while the filtration of part of water with the third filter-member 2c in the sub-water circulation path causes the suspended micro-matter including organic nitrides and decomposed substances to adsorb on the activated carbon.

The first and second filter members 2a and 2b may be disposed either in parallel as illustrated in FIG. 4 or in series.

The first and second filter members 2a and 2b are only required respectively to be capable of physical filtration and biological filtration. The third filter member 2c is only required to contain activated carbon and may be formed into a mass as illustrated in Figure 7 or a pair of masses superposed one on top of the other as illustrated in Figures 8 and 9 in which the upper mass of filter member 2c' comprises chemical fiber having activated carbon fixed thereto and the lower mass of filter member 2a' comprises chemical fiber like the first filter member 2a whereby the suspended micro-matter and macro-matter can be removed at the same time in the sub-water circulation path.

The aquarium tank according to the present invention is not limited to the embodiment shown in Figures 1 to 7 and may be modified by additionally incorporating various practical constructions. As illustrated in Figures 10 and 11, for example, the upright wall 37 of the bottom filter 6 may be constructed to have a height the same as the height of the vertical plate 14 and the periphery of the transversal plate 35 formed with the slit-like small holes 34 may be provided with an enclosure

39. In this case, the tank filter 5 and bottom filter 6 can be easily mounted on or demounted from the tank body 7 at the same time without allowing the second filter member 2b disposed on the bottom filter 6 to fall onto the bottom of the aquarium tank 1 and, at the same time, the inside of the tank 1 can be cleaned with ease.

In the second embodiment of Figures 10 and 11, the upright wall 37 of the bottom filter 6 is provided with a plurality of fifth water passage holes 22e facing the fourth water passage holes 22d of the vertical plate 14.

According to the aquarium tank of the present invention, in any of the illustrated embodiments, it is possible to physically filter off particles, bait residue and fish excrement in the tank with the first filter member in the first filter section, decompose ammonia and organic nitrides contained in the fish excrement into substances free from noxiousness with the bacteria attached to the second filter member in the second filter section and cause the organic nitrides and decomposed substances to adsorb on the activated carbon contained in the third filter member in the third filter section, thus circulating purified water within the tank.

The present invention has been described with reference to the two illustrated embodiments. However, this invention should not be limited to the two embodiments and may be freely modified within the scope of the appended claims.

Furthermore, since the transparent body is applied and attached to the outer frame of the tank body with adhesive so as to watertightly close the open front and sides of the outer frame, it is possible to produce an aquarium tank with ease and since the components including the pump and heater and first and second filter members are captively supported by the outer frame, it is possible to provide an aquarium tank enjoying the aesthetic effect.

Moreover, since the bottom filter is provided with the

upright wall, it can be mounted on or detached from the tank body without allowing gravel etc. to fall onto the bottom of the aquarium tank and since the three filter members can easily be mounted or detached from the tank body along with the components including the heater and pump, change of the filter, inspection of the pump and heater and cleaning of the inside of the tank can be carried out with ease.

CLAIMS:

1. An aquarium tank comprising:

5 a tank body including an outer frame open at the front, sides and top, a transparent body mounted in said outer frame so as to close watertightly the open front and sides and three separately disposed filter members;

10 a tank filter incorporating the first and third filter elements and removably mounted in the watertightly closed tank body and including a vertical plate and a plurality of partitioning members provided on the rear surface of said vertical plate;

15 a bottom filter incorporating the second filter element and removably mounted in said tank body and having an upright wall formed at the rear edge thereof;

a pump and a heater mounted in said tank filter; and

20 a lid incorporating an illumination unit, and electrical wiring connecting the illumination unit, the pump and the heater to a power source;

25 the first filter member being arranged for physical filtration and the third filter member containing activated carbon for absorbing micro-matter each being removably mounted in said tank



filter;

the second filter member incorporating living bacteria and being disposed on the upper surface of said bottom filter for biological filtration, and

5 flow through the filter elements being arranged to cause micro-matter such as fish excrement and bait residue to be filtered off in the first filter member, ammonia and organic nitrides to be deprived of noxiousness by bacteria at the second filter member
10 and suspended micro-matter to then be removed in the third filter member, whereby enabling substantially clear water to be supplied to visible parts of the tank.

15 2. An aquarium tank substantially as hereinbefore described with reference to the accompanying drawings.
