

AIR PUMP FOR AQUARIUM

This invention relates to an air pump for an aquarium for breeding aquarium fish or edible fish. An air pump for supplying air to fresh water or sea water in an aquarium is disclosed in, for instance, Japanese Utility Model Publication No. 57-50546. The disclosed air pump has a case accommodating an electromagnet, a vibrating arm with a permanent magnet provided at one end and facing the electromagnet and a diaphragm coupled to an intermediate portion of the vibrating arm. When the electromagnet is energized, the vibrating arm finely vibrates in a reciprocatory fashion owing to the action of the permanent magnet. This vibration causes expansion and contraction of the diaphragm to cause air to be discharged from an outlet provided in the case.

During operation of the air pump, therefore, the case is finely vibrated and generates a vibrating sound because the vibrating arm vibrates finely and the diaphragm undergoes expansion and contraction. Particularly, since the aquarium and air pump are installed indoors, such fine vibration and vibrating sound will present indoor problems, thus reducing the commercial value of these articles.

This invention has been accomplished in the light of the above, and its object is to provide an air pump for an aquarium, which can markedly suppress vibration and noise.

5 According to the present invention there is provided an air pump for an aquarium comprising a pump case having a first section and a second section coupled together with a vibration absorber disposed between the coupled sections of said case and capable
10 of absorbing vibration, -said vibration absorber having a holding portion for supporting a pump mechanism within said case.

 With the pump mechanism secured to the holding portion of the vibration absorber, vibration
15 generated from the pump mechanism is absorbed by the vibration absorber to reduce the transmission of vibration from the pump mechanism to the pump casing thereby reducing the noise level.

 The invention will be described now by way of example only, with particular reference to the
20 accompanying drawings. In the drawings:

 Figure 1 is an exploded perspective view showing an embodiment of an air pump in accordance with the invention;

25 Figure 2 is a sectional view showing the air pump of Figure 1 in an assembled state;

 Figure 3 is a perspective view showing an air pump mechanism shown in Figure 1 viewed from the back; and

30 Figure 4 is a sectional view showing a different embodiment of an air pump in accordance with the invention.

 Figures 1 to 3 show a first embodiment of the air pump according to the invention. The air pump
35 generally designated by reference numeral 1 has a first section 2 as its base and a second section 3 coupled with the first section from above. The second section 3 is coupled with and

secured by bolts to the first section 2 to complete a pump case 4.

The first section is in the form of a dish with a shallow recess. It has a central raised portion 5 of moderate height, thus defining an annular air storage section 6 open to the top. It also has a plurality of bolt insertion holes 7 formed outside the air storage section 6. It further has a partitioning member 8 provided in the air storage section 6 and an air outlet 9 formed on the outer surface of the first section 2 at a position thereof near the partitioning member 8.

The second section 3 is in the form of an inverted cup. It has an increased thickness portion 10 formed about its lower edge. The increased thickness portion 10 is formed with a cord insertion notch 11.

The second section 3 is coupled to the top of the first section 2, and bolts 12 inserted through the bolt insertion holes 7 are driven into the increased thickness portion, thus completing the pump case 4. At this time, a support disk 13, a first vibration absorber 14 and a second vibration absorber 15 are incorporated such that they intervene between the first and second sections 2 and 3.

The support disk 13 has substantially the same diameter as the second section 3 and has an upright tubular projection 16 formed at an eccentric position.

The first vibration absorber 14 is disk-like and has substantially the same diameter as the support disk 13, and it is made of a synthetic resin having rubber-like elasticity so that it can absorb vibration. The first vibration absorber 14 has a support portion 18 rising from its upper side. The support portion 18 is positioned inward from the edge of the vibration absorber 14 and its sectional profile is substantially that of an inverted L. It has a groove 17. The first vibration absorber 14 also

has a cylindrical portion 19 formed on the inner side of the support portion 18. The cylindrical portion 19 is fitted on the projection 16 of the support disk 13.

The second vibration absorber 15, like the first vibration absorber 14, is made of a synthetic resin having rubber-like character and is capable of absorbing vibration. It is annular and has substantially the same outer diameter as the support disk 13 and first vibration absorber 14. The second vibration absorber 15 has an inner ring-like portion 20 which has substantially the same diameter as the raised portion 5 of the first section 2 and is supported by a plurality of beam portions 21.

The support disk 13 and the first and second vibration absorbers 14 and 15 are formed with holes for inserting bolts 12, these holes being formed in positions corresponding to the bolt insertion holes 7 of the first section 2.

The support disk 13 and the first and second vibration absorbers 14 and 15 are stacked in the order of first vibration absorber 14, support disk 13 and second vibration absorber 15 from above and in this state are inserted between the first and second sections 2 and 3. A pump mechanism 22 is mounted on top of the first vibration absorber 14.

The pump mechanism 22 has a vertical frame 24 mounted on top of a disk-like base 23 and is open on the front. The vertical frame 24 accommodates an electromagnet 25, a vibration arm 27 with a permanent magnet 26 provided at one end and a diaphragm 28 coupled to an intermediate portion of the vibration arm 27. A tube 29 for guiding air discharged from the diaphragm 28 depends from the back side of the vertical frame 24. The base 23 is formed at a position corresponding to the lower end of the tube 29 with a small hole 30.

The pump mechanism 22 is supported upright on top

of the first vibration absorber 14 with the edge of the base 23 fitted in the groove 17 formed in the support portion 18 of the first vibration absorber 14. At this time, the cylindrical portion 19 is inserted upwardly through the small hole 30 to prevent direct contact of the projection 16 with the base 23.

The first vibration absorber 14 supporting the pump mechanism 22 is stacked on top of the support disk 13, the cylindrical portion 19 is fitted on the projection 16, and the lower end of the tube 29 is hermetically fitted on the upper end of the projection 16. Further, the second vibration absorber 15 is placed on the lower surface of the support disk 13 and then the stacked first vibration absorber 14, support disk 13 and second vibration absorber 15 are set on top of the first section 2. Then, the second section 3 is fitted on the pump mechanism 22 with the cord 25' of the electromagnet 25 passed through the notch 11 to the outside of the second section 3. Then, the lower end of the second section 3 is urged against the edge of the top of the first vibration absorber 14, and screws 12 are passed upwardly through the bolt insertion holes 7 and firmly driven into the increased thickness portion 10. If necessary, bolts 12' may be driven from the lower surface of the raised portion 5 into the lower surface of the support disk 13 for even firmer securement of the first section 2 with the support disk 13.

When the air pump 1 is assembled in this way, the first vibration absorber 14, the support disk 13 and the second vibration absorber 15 intervene between the coupled portions of the first and second sections 2 and 3, so that the pump mechanism 22 which generates vibration and noise is supported solely by the first vibration absorber 14 and is not in contact with the second section 3 or first section 2. Besides, air discharged from the diaphragm 28 is transmitted through the flexible tube 29 to the air

storage section 6 to fill the section 6 before being discharged from the outlet 9.

Thus, the air pump 1 does not generate fine vibration or noise but is very quiet during operation.

With the outer periphery of the support portion 18 retained by the inner periphery of the lower end of the second section 3, the support portion 18 cannot be bent, so that the support of the pump mechanism 22 is reinforced. Further, pulsating air flow discharged from the diaphragm 28 is buffered by being stored in the air storage section 6, so that air does not flow out as a pulsating flow from the outlet 9. Thus, regular air bubbles are formed in the aquarium.

Figure 4 shows a second embodiment of the invention. The air pump 1 of this embodiment is rectangular in shape. This embodiment is the same in construction as the first embodiment except that the second vibration absorber 15 is not provided, that the first vibration absorber 14 is formed in the shape of a rectangular ring by removing its central portion and that the tube 29 is directly fitted on the projection 16 of the support disk 13.

Parts shown in Figure 4 and designated by numerals like those in the case of the first embodiment are alike in construction.

While two preferred embodiments of the invention have been described in the foregoing, they are by no means limitative, and changes and modifications may be made without departing from the scope of the invention as set forth in the accompanying claims.

According to the invention, the pump mechanism which generates fine vibration and noise is supported by the first vibration absorber and is not in contact with the pump case, so that vibration generated from the pump mechanism is substantially entirely absorbed by the first

vibration absorber to eliminate fine vibration of the pump case. In addition, since air discharged from the pump mechanism is stored in the air storage section before being discharged through the outlet, it is possible to prevent pulsating flow of discharged air. Thus, the air pump according to the invention may be used indoors or at night without any problem of generation of fine vibration or noise, so that it is highly useful in practice.



CLAIMS:

1. An air pump for an aquarium comprising a pump case having a first section and a second section coupled together with a vibration absorber disposed between the coupled sections of said case and capable of absorbing vibration, said vibration absorber having a holding portion for supporting a pump mechanism within said case.
 2. An air pump for an aquarium according to claim 1, wherein said first section is formed with an air storage section, air discharged from said pump mechanism being supplied to said air storage section before being discharged to the outside.
 3. An air pump according to claim 1 or claim 2, wherein said first section is generally dish-shaped, said second section is an inverted cup-shape;
and said vibration absorber is a disk-like vibration absorber, and
wherein said pump mechanism is accommodated in said inverted cup-shape section by securing said pump mechanism to said holding portion of the vibration absorber.
 4. An air pump for an aquarium substantially as hereinbefore described with reference to and as shown in the accompanying drawings.
-