An Economical Cooling System for Aquaria

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How to use a refrigerator to cool aquaria is detailed here, and plans are explained for its construction.

Currently much national attention is being focused on the study of the sea. This, along with interest in water sports, has aroused student interest in marine and estuarine organisms. The study of these organisms in some coastal areas is limited by the difficulty of maintaining the proper water temperature in the laboratory.

Organisms may be held for short periods in plastic buckets in a refrigerator. Exposing part of the aquarium to outside air through an open window may be used to maintain reduced water temperature in cool climates. Temperatures fluctuate rather widely in the latter system and the former method is temporary at best.

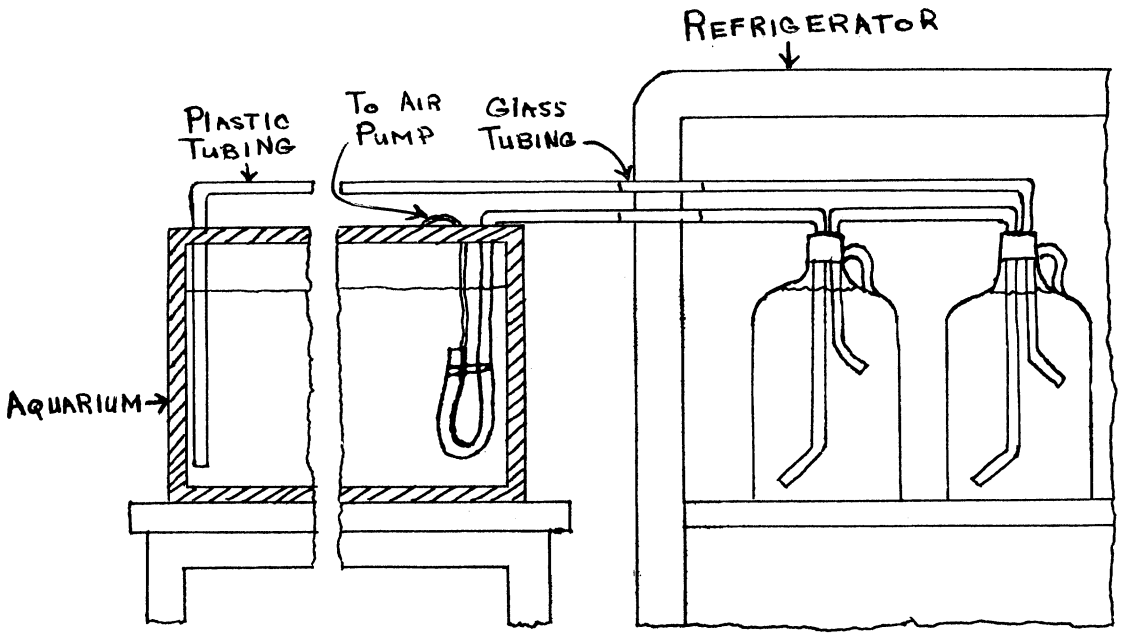

Fig. 1. General view of aquarium cooling system.

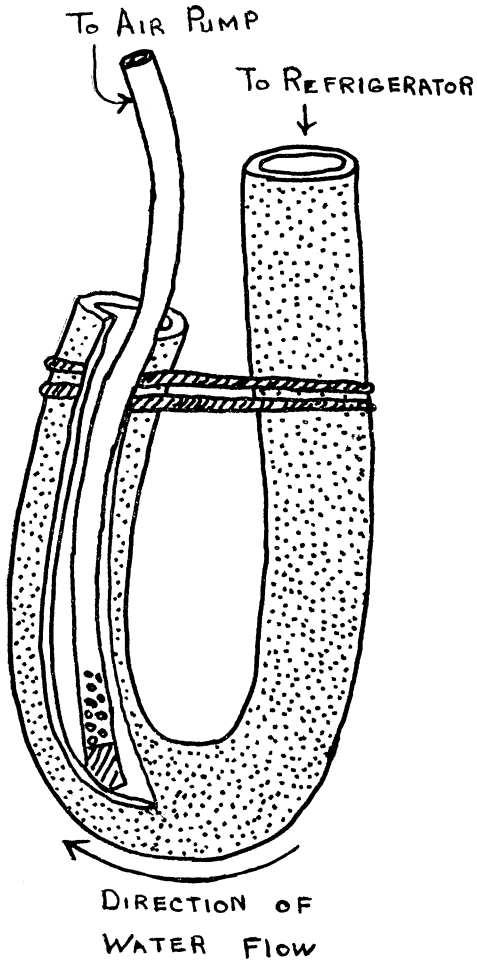

Fig. 2. Cutaway view of bubble pump used to circulate water.

A satisfactory marine aquarium requires refrigeration. Since commercial refrigerated aquaria are expensive, the following system was developed. The materials required are:

Part of a shelf in the laboratory refrigerator
Glass tubing
Plastic tubing
Rubber stoppers
Several gallon jars
Aquarium
Aquarium air pump
Aquarium stand or table

The method consists of circulating water from the aquarium into the refrigerator and back into the aquarium. Fig. 1 shows the general layout.

The circulation depends on the siphon principle and an air bubble pump. The bubble air is forced down the small tube which is blocked at the end with a glass rod. Air escapes into the big tube through perforations just behind the rod. As the air bubbles rise in the larger tube, they lift water ahead of them. Water from the containers in the refrigerator is drawn into the large tube to replace that leaving ahead of the air bubbles. As the water is drawn from the containers in the refrigerator, water siphons from the far end of the aquarium into the cooling area.

Several models have been made based on this idea. The first step in establishing a system like our latest model is the placement of glass bends in the filled gallon jugs. The jugs are then placed in the refrigerator as shown in Fig. 1. If the jugs and aquarium are not placed so that the water levels are the same, the adjustment by siphoning will result in partially filled jugs, partially filled aquarium, or a wet laboratory floor.

Plastic tubing is run from the jugs to the area where the rubber gasket on the refrigerator door meets the wall of the box. Pieces of flattened glass tubing substituted for the plastic in this area will allow water flow without much distortion of the seal. The remainder of the system is plastic tubing.

The pump shown in Fig. 2 is constructed by tying the end of the plastic tubing into a loop and inserting the smaller tubing leading from the aerator pump. Before the air bubble pump will function, all the air must be removed from the line. The easiest method seems to be to attach a funnel to the end of the plastic tubing leading to the refrigerator and pour water into the line until it is full. When the water system is continuous, the air pump may be started and circulation will begin.

Many adjustments such as tubing size, refrigerator temperature, percentage of total water in the refrigerator, flow rate and aquarium insulation can be used to adjust the temperature to the desired level. The jugs in our refrigerator hold about 30% of the total water in the system, and three sides and the bottom of the aquarium are covered with Celotex in order to reduce heat gain. Under these conditions, the temperature of the aquarium water stays between 12-14° Celsius.