The Demonstration ::

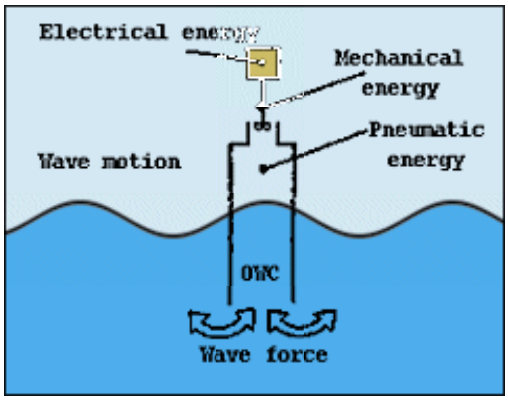


Figure 3

(1) Give a brief (3-minute) overview of the need to develop renewable energy sources and the potential of ocean waves. A chalkboard sketch of Figure 3 of this guide might help the students better understand the oscillating water column process. Also pose the following problem to the students: "How can the reversing air flow of the oscillating water column be converted to one-way rotation of a generator shaft?" Each team should come up with its best solution while waiting for (and after) its turn to watch the

(6) A one-way flap valve is a better solution because it has fewer moving parts (only the flap valve hinge, as opposed to multiple gears or turbine blade hinges), can use the standard turbine design without requiring new manufacturing equipment (£££!), and is totally removed from the power train for ease of repair or replacement.

(7) Remove the strip of tape that was covering the flap valve window, and repeat the demonstration of Step (3), so that each team of students can verify that indeed, the turbine blades spin in one direction regardless of whether the bottomless bottle is moving up or down (Figure 8).

demonstration.

(2) Fill the bucket or sink to within 2-3 inches of the top, if this hasn't already been done.

(3) Demonstrate to each team that as the bottomless bottle is moved up and down, the turbine "whistles." The students should be given a chance to look down into the whistle to see the turbine blades reversing direction at the top and bottom of each stroke (Figure7). Ask them to speculate on the negative consequences of this direction reversal ("interrupted or uneven flow of power," "high stress on the turbine

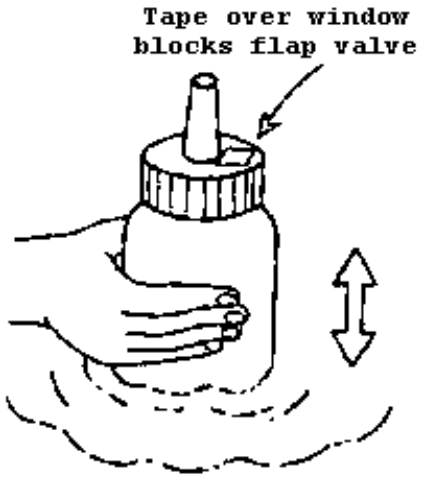
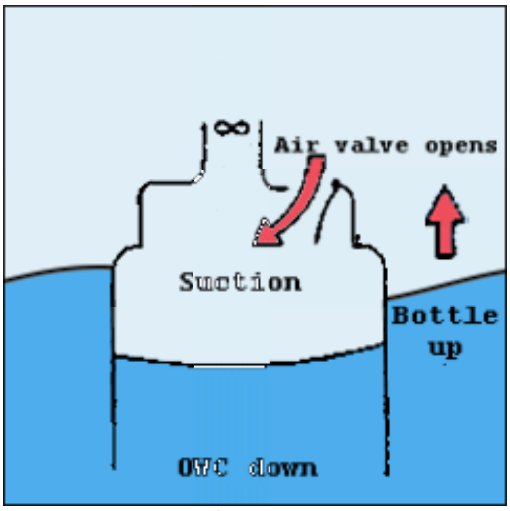
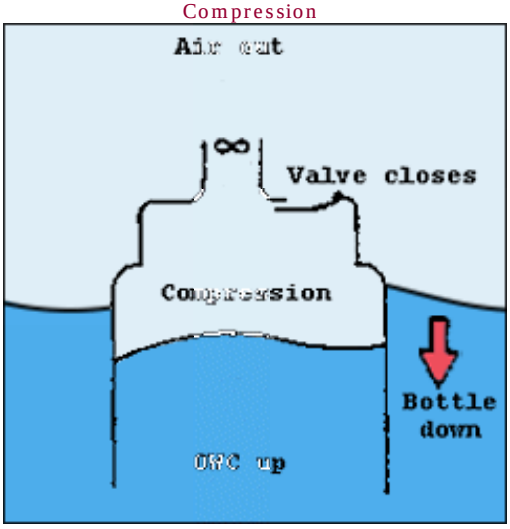


Figure7

(4) Once all teams have seen the first part of the demonstration, each one should describe its best solution to the direction reversal problem. Ask the teacher to list these on the board. Some teams may suggest complex gear mechanisms or hinged turbine blades. Others may say it can't be solved. Any team suggesting a one-way valve will be rewarded with the satisfaction of seeing their idea work in actual practice!



Suction
Figure 8
Compression



(8) If time permits, you can explain that it is the flywheel inertia of the turbine that keeps it spinning while air is being drawn in through the flap valve. Can the students think of a valve system that would direct air through the turbine on both strokes? One possible solution is shown in Figure 9

(5) While going over the list of solutions on the board, emphasise that engineers are creative problem solvers, and that part of the engineering process is to find solutions that are "elegant but simple." A gear mechanism for the oscillating water column may be elegant, but is more complex than other solutions, involving many moving parts requiring lubrication and eventual replacement when they wear out. Hinged turbine blades are subject to high stress as they flip at the end of each stroke—the failure of a single blade may require disassembly of the entire turbine to replace the failed blade. In addition to being functional, a well-engineered design should also be reliable (long-term durability), economical (both to build and maintain) and practical (ease of repair or replacement)

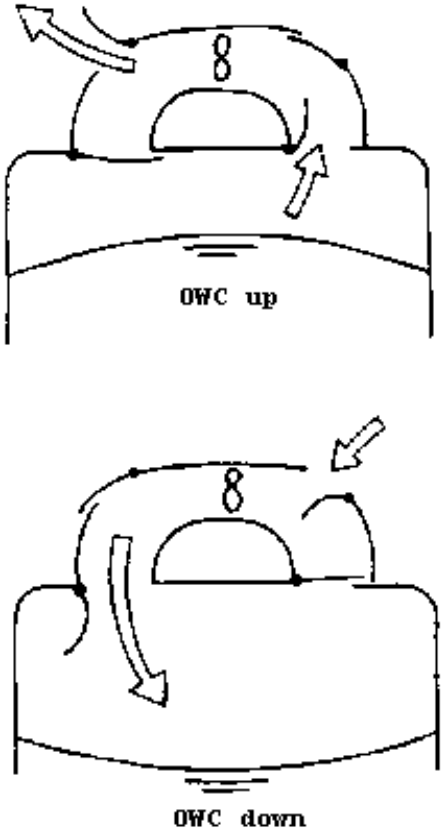


Figure 9

To go onto the 5th of 5 pages click on

:: **Extended Activities** ..

colleague